THE SCHOOLMASTER'S ASSISTANT, BEING A COMPENDIUM OF ARITHMETIC, BOTH *Practical and Theoretical.*

In FIVE PARTS.

CONTAINING

I. Arithmetic in whole Numbers, wherein all the common Rules, having each of them a sufficient Number of Questions with their answers, are methodically and briefly handled.

II. Vulgar Fractions, wherein several Things not commonly met with, are there distinctly treated of, and laid down in the most plain and easy manner.

III. Decimals, in which, among other Things, are considered the Extraction of Roots: Interest, both Simple and Compound; Annuities; Rebate, and Equation of Payments.

IV. A large collection of Questions with their Answers, serving to exercise the foregoing Rules, together with a few others, both pleasant and diverting.

V. Duodecimals, commonly called Cross Multiplication; wherein that Sort of Arithmetic is thoroughly considered, and rendered very plain and easy; together with the method of proving all the foregoing operations at once by Division of several Denominations, without reducing them into the lowest Terms mentioned.

The whole being delivered in the most familiar way of Question and Answer, is recommended by several eminent Mathematicians, Accomptants and Schoolmasters, as necessary to be used in Schools by all teachers, who would have their Scholars thoroughly understand, and make a quick progress in ARITHMETIC.

To which is prefixed, an ESSAY on the Education of YOUTH; humbly offered to the consideration of Parents.

A NEW EDITION.

BY THOMAS DILWORTH,
Author of the New Guide to the English Tongue, Young Book-keeper's Assistant, &c and Schoolmaster in Wapping

All Things, which from the very original Being of Things, have been framed and made, do appear to be framed by the Reason of number: for this was the principal Example or Pattern in the Mind of the Creator

AN. BOETIUS.

Thou [O Lord] hast ordered all Things in Measure, Number and Weight.

WISDOM xi. 2.

LONDON:
PRINTED FOR THE BOOKSELLERS.

1798.

AN

ESSAY

ON THE

EDUCATION OF YOUTH,

HUMBLY OFFERED TO

THE CONSIDERATION OF PARENTS.

THE right education of children, is a thing of the higheſt importance, both to themſelves and the Commonwealth. It is this which is the natural means of preſerving religion and virtue in the world; and the earlier good inſtructions are given, the more laſting will be the impreſſion; for it is as unnatural to deny theſe to children, as it would be to withhold from them their neceſſary ſubſiſtence. And happy are thoſe, who, by a religious education and watchful care of their parents, their wiſe precepts and good examples, have contracted ſuch a love of virtue and hatred of vice, as to be removed out of the way of temptations. And it is owing to the want of this education that many when they leave their ſchools, do not prove ſo well qualified as might be expected. This great omiſſion, being, for the moſt part, chargeable on the parents, I hope the following particulars (which are the common voice of our profeſſion) will not be taken amiſs. And,

1. A conſtant attendance at ſchool is one main axis whereon the great wheel of education turns. Therefore, if that obſervation which is commonly made by parents be true, that the maſters have holidays enough of their own making, there is, by their own confeſſion, no neceſſity for them to make an addition.

2. Parents ſhould never let their own commands run counter to the maſter's, but whatever taſk he impoſes on his pupils, to be done at home, they ſhould be careful to have it performed in the beſt manner, in order to keep them out of idleneſs. "For vacant hours move on heavily, and drag ruſt and filth along with them; and it is full employ-"ment and a cloſe application to buſineſs, that is the only barrier to "keep out the enemy, and ſave the future man †."

3. Parents themſelves ſhould endeavour to be ſenſible of their children's defects and want of parts; and not blame the maſter for neglect,

† Watt's Eſſays,

when his greatest skill, with some, will produce but a small share of improvement But the great misfortune, is, as the proverb expresses it; Every bird thinks her own young the fairest; and the tender mother, though her son be of an ungovernable temper, will not scruple to say, He is a meek child, and will do more with a word than a blow, when neither words nor blows are available. On the other hand, some children are of a very dull and heavy disposition; and are a long time in gathering but a little learning, and yet their parents think them as capable of instruction as those who have the most bright and promising parts; and when it happens that they improve but slowly, though it be in proportion to their own abilities, they are hurried about from school to school, till at last they lose that share of learning which otherwise, by staying at the same school, they might have been masters of. Just like a sick, but impatient man, who employs a physician to cure him of his malady and then, because the distemper requires time as well as skill to procure his health, tells him, "He has all along taken a wrong method," turns him off, and then applies to another, whom he serves in the same manner: and so proceeds till the distemper proves incurable.

4. It is highly necessary that children should be early made sensible of the scandal of telling a lie: To this end parents must inculcate upon them betimes, that most necessary virtue of speaking truth, as one of the best and strongest bands of human society and commerce, and the foundation of all moral honesty.

5. In justice (I mean the tricking each other in trifles, which so frequently happens among children, and is very often countenanced by the parents, and looked on as the sign of a very promising genius) ought to be discouraged betimes, lest it should betray them into that vile sin of pilfering and purloining in their riper years: to which the grand enemy of mankind is not wanting to prompt them by his suggestions, whenever he finds their inclinations have a tendency that way

6. Immoderate anger and desire of revenge must never be suffered to take root in children. For (as a most Reverend divine observes †) "If any of these be cherished, or even let alone in them, they will, in a short time, grow headstrong and unruly; and when they come to be men, will corrupt the judgement, turn good nature into ill humour, and understanding into prejudice and wilfulness."

7. Children are very apt to say at home what they see and hear at school, and often times more than is true; some parents, as often, are weak enough to believe it. Hence arises those great uneasinesses between the parents and the master, which sometimes are carried so high, as for the parent, in the presence of the child to reproach him with hard names, and perhaps with more abusive language. On the contrary,

8. If parents would have their children improve in their learning, they must cause them to submit to the little (imaginary) hardships of the school, and support them under them by suitable encouragements. They should not fall out with the master upon every idle tale, nor even give their children the liberty of expressing themselves that way; but they should by all means inform them frequently, 'That they ought to be good boys, and learn their book, and always do as their master bids them, and that if they do not, they must undergo the pain of correction.' And it is very observable what a harmony there is between the master and the scholar, when the latter is taught to love and have

† Abp. Tillotson.

good opinion of the former; and then "With what eaſe does the ſcholar learn! With what pleaſure does the maſter communicate!"

9. The laſt thing that I ſhall take notice of is, That while the maſ-r endeavours to keep peace, good harmony and friendſhip among his holars, they are generally taught the reverſe at home "It is indeed but too common for children to encourage one another, and be encouraged by their friends in that ſavage and brutiſh way of contention, and count it a hopeful ſign of *mettle* in them to give the *laſt blow*, if not the firſt, whenever they are provoked: forgetting at the ſame time, that to teach children betimes to love and be good-natured to others, is to lay early the true foundation of an honeſt man. Add to this, that cruel delight which ſome are ſeen to take in tormenting and worrying ſuch poor animals and inſects as have the misfortune to fall into their hands. But children ſhould not only be reſtrained from ſuch barbarous diverſion, but ſhould be bred up from the beginning to an abhorrence of them †," and at the ſame time be taught that great le of humanity, "To do to others as we would they ſhould do to us." From what has been ſaid relating to the management of children at me, the neceſſity of the parents joining hands with the ſchoolmaſter pears very evidently. For when the maſter commands his pupils to nploy their leiſure time in getting ſome neceſſary parts of learning, eir friends ſhould not command them to forbear: And when they ght to be at ſchool at the ſtated hours, they ſhould not be ſent an ur or two after, in the time of health, ſometimes with a lie in their s to excuſe their tardineſs, and ſometimes with an order, and a brazen nt, to tell their maſter, their friends think it time enough to come ſchool at nine in the morning, becauſe the weather is a little cold, or auſe they muſt have their breakfaſt firſt. I ſay parents ſhould not act ndiſcreetly, becauſe it clips the wings of the maſter's authority. It kes boys firſt deſpiſe and undervalue their teachers, and then become nannerly and impertinent to them; correction for which makes the or hated by the children, and then there naturally follows either a l diſregard to buſineſs, or a general careleſſneſs in every thing they And,

Vhile I am ſpeaking of the education of children, I hope I ſhall be iven, if I drop a word or two relating to the fair ſex.—It is a grand ark, that they are ſo unhappy as ſeldom to be found either to ſpell, e, or cypher well: and the reaſon is very obvious, becauſe they do ſtay at their writing ſchools long enough. A year's education in ing is, by many, thought enough for girls; and by others it is ght time enough to put them to it when they are eighteen or nty years of age; whereas, by ſad experience, both theſe are found e. the one too ſhort a time, and the other too late. The firſt is a too ſhort, becauſe when they are taken from the writing-ſchool. generally forget what they learnt, for want of practice; and the r too late, becauſe then they are apt to look too forward, imagine ings will come of themſelves without any trouble, and think they earn a great deal in a little time; and when they find they cannot paſs their ends ſo ſoon as they would, then every little difficulty diſ-ges them: And hence it is, that adult perſons ſeldom improve in firſt principles of learning ſo faſt as younger ones. For a proof of

† Talbot's Chriſtian Schoolmaſter.

this, I appeal to every woman whether I am juſt in my ſentiments not. The woman who has had a liberal education this way, knows t advantages that ariſe from the ready uſe of the pen; and the wom who has learnt little or nothing of it, cannot but lament the want of Girls therefore ought to be put to the writing ſchool as early as boys, a continued in it as long, and then it may reaſonably be expected th both ſexes ſhould be alike ready at their pen. But for want of this, h often do we ſee women, when they are left to ſhift for themſelves the melancholy ſtate of widowhood (and what woman knows that ſhall not be left in the like ſtate?) obliged to leave their buſineſs to t management of others; ſometimes to their great loſs, and ſometim to their utter ruin; when on the contrary, had they been ready at th pen, could ſpell well, and underſtand figures, they might not only ha ſaved themſelves from ruin, but perhaps have been miſtreſſes of go fortunes. Hence then may be drawn the following, but moſt natu concluſion, viz. "The education of youth is of ſuch vaſt importan "and of ſuch ſingular uſe in the ſcene of life, that it viſibly carries "own recommendation along with it: For on it, in a great meaſu "depends all that we hope to be; every perfection that a generous a "well-diſpoſed mind would gladly arrive at. It is that that ſtamps t "diſtinction of mankind, and renders one man preferable to anoth "is almoſt the very capacity of doing well; and remarkably adorns ev "point of life †." And as the great end of human learning is to teac man to know himſelf, and thereby fit him for the kingdom of h ven: ſo he that knows moſt, conſequently is enabled to practiſe the b and become an example to thoſe who know but little, or are quite ig rant of their duty.

I am,

Your and your children's well-wiſher.

THOMAS DILWOR

† Watt's Eſſay,

THE TABLE OF

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OF DUODECIMALS.

The Explication of ſome Marks uſed in this COMPENDIUM.

$=$ TWO parallel lines are the marks of Equality; as 12 *oz.* $=$ 1 *lb.* ſignifies that 12 ounces are equal to 1 pound.

$+$ Saint George's croſs ſignifies more, or Addition; as $4+2=6$; *i. e.* 4 more 2, are equal to 6.

$-$ A ſtraight line ſignifies leſs, or Subtraction; as $4-2=2$; *i e* 4 leſs 2, are equal to 2.

$\times$ Saint Andrew's croſs denotes Multiplication; as $4\times 2=8$; *i. e.* 4 multiplied by 2, are equal to 8.

$\div$ A line between 2 points, or between 4 points, is the ſign of Diviſion; as $4\div 2$ or $\div 2=2$; *i. e.* 4 divided by 2, are equal to 2.

The reverſed Parentheſes denote Diviſion alſo; as 2)4(2; *i. e.* 4 divided by 2, are equal to 2.

$\frac{6}{2}$ Numbers placed in a fraction-like manner, do likewiſe denote diviſion; the lower number being the Diviſor, and the upper number the dividend.

Four points, ſet in the middle of four numbers, denote them to be proportioned to one another by the Rule of Three; as 2 : 4 :: 8 : 16; that is, as 2 is to 4, ſo is 8 to 16.

B Some maſters, inſtead of points, uſe long ſtrokes to keep the terms ſeparate, but it is wrong to do ſo; for the two points between the firſt and ſecond terms, and alſo between the third and fourth terms ſhew that the two firſt and the two laſt terms are in the ſame proportion. And whereas four points are put between the ſecond and third terms, they ſerve to disjoin them, and ſhew that the ſecond and third, and firſt and fourth terms, are not in the ſame direct proportion to each other as are theſe before-mentioned.

Money.

£. Libræ, Pounds.
S Solidi, Shillings.
D Denarii, Pence.
Qrs. Quadrantes, Farthings.

$\overline{2+3}\times 5=25$, Signifies that the ſum of 2 and 3 multipli[ed] by 5, is equal to 25.

$\overline{3-2}\times 5=5$, Signifies that the difference between 3 and [2] multiplied by 5, is equal to 5.

$\sqrt{\ }$ or $\sqrt{\ }q$. Prefixt to any number ſuppoſes that the ſqua[re] root of that number is required. Sometimes it [is] the ſign of irrationality, and ſignifies that t[he] ſquare-root of ſuch a number can never be tru[ly] found.

$\sqrt[3]{\ }c$ Prefixt to any number, ſuppoſes that the cube-ro[ot] of that number is required, Sometimes it is t[he] ſign of irrationality, and ſignifies that the cub[e-] root of ſuch a number can never be truly foun[d].

$3aa+3a$, Signifies 3 times the ſquare of a, more 3 times [a].

$3aae+3eea+eee$, Signifies 3 times the ſquare of a, multipli[ed] by e, more 3 times the ſquare of e, multiplied [by] a, more the cube of e, as in the cube-root.

THE

SCHOOLMASTER'S ASSISTANT.

PART I.

OF ARITHMETIC IN WHOLE NUMBERS.

INTRODUCTION.

Of Arithmetic in general.

Q. WHAT is Arithmetic?

A. Arithmetic is the art or ſcience of computing by numbers, either whole or in fractions.

Q. What is Number?

A. Number is one or more quantities, anſwering to the queſtion, How many?

Q. What is Arithmetic in Whole Numbers?

A. Arithmetic in Whole Numbers, or Integers, ſuppoſes numbers to be entire quantities, and not divided into parts.

Q. What is Arithmetic in Fractions?

A. Arithmetic in Fractions, ſuppoſes its numbers to be the parts of ſome entire quantity.

Q. How do you conſider Arithmetic with regard to art and ſcience?

A. Both in theory and practice.

Q. What is Theoretical Arithmetic?

A. Theoretical Arithmetic conſiders the nature and quality of numbers, and demonſtrates the reaſon of practical operations. And in this ſenſe Arithmetic is a ſcience.

Q. What is Practical Arithmetic?

A. Practical Arithmetic is that which ſhews the method of working by numbers, ſo as may be moſt uſeful and expeditious for buſineſs. And in this ſenſe Arithmetic is an Art.

Q. What is the nature of all Arithmetical Operations?

A. The nature of all Arithmetical Operations is, by ſome quantities that are given, to find out others that are required.

Q. Which are the Fundamental Rules in Arithmetic?

A. Theſe five: Notation, Addition, Subtraction, Multiplication, and Diviſion.

OF NOTATION.

Q. WHAT is Notation?

A. It is the Art of expressing Numbers by certain characters or figures.

Q. What is the use of Notation?

A. Notation teaches us to read and write numbers by their true value?

Q. How many sorts of Characters or Figures are numbers usually expressed by?

A. Two, *viz* The Arabic Figures, and the Latin Letters

Q. How are the Arabic Figures expressed?

A. The Arabic Figures are thus expressed; One 1, Two 2, Three 3, Four 4, Five 5, Six 6, Seven 7, Eight 8, Nine 9, Nought or Cypher 0. And this is the Notation or reading and writing of every single figure.

Q. How far may the use of these Figures be extended?

A These ten Characters or Figures may be used to express all manner of numbers, from the least to the greatest, that can be conceived; even without end.

Q. How many Figures are sufficient to express most ordinary concerns?

A. Nine: and therefore the table of Notation commonly extends no farther than to nine places.

Q. Why does it consist of nine places rather than of eight or ten?

A. Because they make up three even Periods.

Q. What do you mean by a Period?

A A. Period is a quantity expressed by three figures whereof the first to the right hand signifies so many units single things; the second so many tens; and the third many hundreds.

Q. Why are three figures called a period?

A. Because if the number be increased above three places there is still the same periodical return of the value of the places, and every third figure to the left hand will always be hundreds, if it be ever so far extended.

Q. Is a Unit, or one, a Number?

A. A Unit is a Number, because it may properly answ the question, How many?

Q. Give an example or two?

A. How many Gods do we believe? the answer is O How many Sundays in the Compass of a week? Ans. O

Q. In what nature, or proportion of value, do Numb increase from the Unit's place to the left hand? *A.* By Te

Q. How muſt they be read?

A. From the left to the right hand.

Q. If two figures are given to be read together, how muſt they be valued?

A. The firſt figure towards the right hand is Units, and the next to that is ſo many Tens; as 89, Eighty-nine. Where 9 is in the place of Units, and 8 is in the place of Tens; for 8 tens are properly called Eighty.

Q. If three figures or a whole Period be given, how is it to be valued?

A. Beginning at the laſt figure on the right hand, I value them Units, Tens, Hundreds; as 789, ſeven hundred and eighty-nine.

Note 1. As every third Figure from the place of Units, bears the name of Hundreds: So for any great ſum to be diſtinguiſhed into Periods (as in the following tables) will be of good uſe to the learner, in the eaſier valuing and expreſſing that ſum.

2. There is alſo another ſort of Periods, which ſome diſtinguiſh thus, viz. Millions, Millions of Millions, &c and others thus, viz Millions, Billions, Trillions, &c each period conſiſting of ſix places; but as Periods of this kind ſeldom or never occur in buſineſs it is ſufficient only to mention them in this place, without ſaying any thing further about them

TABLE I.

Third Period.			Second Period.			Firſt Period.		
C Millions	X Millions	Millions	C Thouſands	X Thouſands	Thouſands	Hundreds	Tens	Units
								9
							8	9
						7	8	9
					9	7	8	9
				8	9	7	8	9
			7	8	9	7	8	9
		9	7	8	9	7	8	9
	8	9	7	8	9	7	8	9
7	8	9	7	8	9	7	8	9

TABLE II.

Third Period.			Second Period.			Firſt Period.		
C Millions	X Millions	Millions	C Thouſands	X Thouſands	Thouſands	Hundreds	Tens	Units
								4
							7	3
						9	6	5
					3	4	7	2
				4	8	9	1	3
			7	3	1	2	3	6
		3	1	2	7	1	4	8
	4	3	1	9	2	7	6	4
5	7	3	1	2	9	8	4	2

Note, See the Notation of Numbers by Latin Letters in the New Guide to the Engliſh Tongue, p 88.

EXAMPLES *for practice.*

Write down in proper figures the following numbers, viz.

Twenty-nine

Three hundred and forty eight.

Seven thousand, two hundred and twenty-six.

One thousand, three hundred and ninety.

Nineteen thousand, seven hundred and twenty-eight.

Four hundred and twenty-seven thousand, three hundred and ninety six

Nine hundred and forty two thousand, seven hundred.

Four million, seven hundred and eighty-nine thousand, three hundred and twenty eight

Seven million, nine hundred and forty-two thousand, four hundred and seventy five.

Twenty six million, three hundred and fourteen thousand, one hundred and ninety-five

One hundred and ninety seven million, four hundred and thirty six thousand, one hundred and ninety one.

Seven hundred and fourteen million, one hundred and nineteen thousand, seven hundred and four

Write down in words at length the following numbers, viz.

7 —— 9 —— 846 —— 7428 —— 61261 —— 370141 —— 7126172 —— 74680218 —— 461272615.

OF ADDITION.

Q. WHAT is the use of Addition?

A. Addition teacheth to bring several particular numbers into one total sum.

Q. How many sorts of Addition are there?

A. Two, *viz.* Simple and Compound

OF SIMPLE ADDITION.

Q. What is simple Addition?

A. Simple or single Addition, is the adding of several numbers together, whose signification is the same; as 6 yards and 8 yards make 14 yards.

Q. If several numbers are given to be added into one sum, how are they to be placed?

A. They must be placed in such manner, that Units may stand under Units, Tens under Tens, &c. Pounds under Pounds, Shillings under Shillings, &c.

Q. How do you prove Addition?

A. The best way of proving Addition is to begin at the top of the sum, and reckon the figures downwards in the

same manner that they were added upward: and if the second line, or sum total be equal to the first, it is right.

Examples *for Practice.*

£.	*Yds.*	*Gals.*	*Tons.*	*Hhds.*	*lb.*
4	43	764	3746	47476	461713
7	17	147	7416	73712	761710
3	19	387	3406	31819	476312
2	13	736	7198	41243	126712
1	37	197	3173	71208	310748
7	46	473	4731	70956	471381
6	23	382	1264	84161	704714
4	59	769	4731	31269	311624
7	94	367	7179	74196	781462

Miles.	*Leagues.*	*Years.*
4734736	46431734	3473 2484
3474315	72261374	168126312
4161321	12611714	718126191
7369138	31371261	731618191
3143618	74147312	312134716
4732216	47312641	171216198
4713147	84167571	312614712
3712612	31216126	171614712
7126981	31187412	312814795

Of COMPOUND ADDITION.

Q. What is Compound Addition?

A. Compound Addition is the adding of several numbers together, having divers denominations.

1. Of MONEY.

Q. Which are the denominations of English Money?

A.

4	Farthings	make	1 Penny.
12	Pence	——	1 Shilling.
20	Shillings	——	1 Pound sterling.

Q. Are there no other names of Money used in England?
A Yes; such as,

		£.	s.	d.
A Moidore	=	1	7	0
A Guinea	=	1	1	0
A Half Guinea	=	0	10	6
A Crown	=	0	5	0
A Half Crown	=	0	2	6

††† There are also several smaller pieces which speak their own values, as a Sixpence, Fourpence, Threepence, Twopence, Penny, Halfpenny, and Farthing

Note. The following pieces were formerly current, but now not so, being only imaginary.

A Jacobus	=	1	5	0
A Carolus	=	1	3	0
A Mark	=	0	13	4
An Angel	=	0	10	0
A Noble	=	0	6	8

The Pound sterling is also an imaginary sum.

Q. Are there not some tables that may be learned by heart?
A. Yes; these following called Pence Tables.

d.		s.	d.	s.		d.
20	=	1	8	2	=	24
30	=	2	6	3	=	36
40	=	3	4	4	=	48
50	=	4	2	5	=	60
60	=	5	0	6	=	72
70	=	5	10	7	=	84
80	=	6	8	8	=	96
90	=	7	6	9	=	108
100	=	8	4	10	=	120
110	=	9	2	11	=	132
120	=	10	0	12	=	144

Note 1. Though I say these tables may be learnt by heart, I do not say they must, for then by the same rule, it would be necessary to have tables to every rule in Addition which nobody uses, and not every one the Pence Tables; because when they are learnt ever so perfectly, their use extends no farther than Money; and therefore, they may very well be omitted, and a better method substituted in their room; I mean that of pointing, which I am sure is both easier and safer, to beginners especially. However, I chose to set them down in their place, that they who approve of them may use them; and those who do not can easily omit them.

2. As all the parts of Addition are built upon the same reason, so the method of pointing may serve as a general rule, when any denomination is to be added; and this may be done without defacing the figures.

Examples.

£.	s.	d.
4	3	6
1	7	8¼
2	7	4
1	9	4½
3	1	3¼
1	2	1
4	7	6½
3	1	9

£.	s.	d.
1	1	3
3	8	1¼
1	1	6
3	4	7½
1	2	6
3	2	8½
7	4	6
4	1	7¾

£.	s.	d.
4	1	6½
1	2	7
3	1	4½
3	3	6
1	4	1½
3	1	2
1	5	8½
3	1	2

£.	s.	d.
14	12	1¾
17	11	2½
19	12	1½
16	13	1
12	13	6¼
14	12	7¾
19	13	4
12	11	6

£.	s.	d.
9	13	4
2	11	6
7	14	1
9	13	4
2	11	6
[illegible]	13	1
[illegible]	12	1
[illegible]	11	4

£.	s.	d.
47	12	11
17	10	11
17	10	4½
32	12	6
11	19	4
12	12	6¾
11	13	1
11	11	2¼

£.	s.	d.
21	12	10½
31	11	11½
47	12	10¼
19	11	4
31	12	6½
12	11	4¾
79	11	4
31	11	3

£.	s.	d.
12	13	10
71	16	8
19	4	6¼
12	3	1
26	1	6
31	11	1
14	12	6¾
18	18	7

£.	s.	d.
[illegible]	12	6¼
[illegible]	18	1½
[illegible]	12	4
[illegible]	12	10¾
[illegible]	14	11
[illegible]	12	2
[illegible]	11	3
[illegible]	11	1¼

£.	s.	d.
21	11	11½
16	12	6
11	9	10½
16	12	4¼
34	1	10
17	14	11½
72	3	8¾
14	1	4

£.	s.	d.
47	12	6½
31	17	3
17	13	11¾
18	14	10½
16	15	11
19	14	4½
77	18	6
71	18	6

£.	s.	d.
47	11	2¼
31	17	3
17	13	10¾
18	15	10½
16	15	11
17	15	3¼
11	18	6
17	17	3

A MERCER'S BILL.

Bought of *George Bailey*, May 17, 1793.

		£.	s.	d.		£.	s.
9	Yards of silk. —	at	14	6	*per* yd.	6	10
12	Yards of flowered silk	at	16	8	—	10	0
16	Yards of sarsenet —	at	6	9	—	5	8
10	Yards of satin —	at	9	6	—	4	15
15	Yards of Brocade —	at	10	8	—	8	0
11	Scarves —	at	2	0	each	1	2
14	Yards of Genoa velvet	at	17	4	*per* yd.	12	2
10	Yards of lustring —	at	5	2	—	2	11
					Sum		

A WOOLLEN DRAPER'S BILL.

Bought of *Thomas Simmons*, June 19, 1794.

			s.	d.		£.	s.
16	Yards of Drugget —	at	7	0	*per* yd.	5	12
12	Yards of broad cloth —	at	15	0	—	9	0
9	Yards, of black cloth —	at	16	5	—	7	7
10	Yards of Shalloon —	at	1	8	—	0	16
15	Yards of serge —	at	1	10	—	1	7
7	Yards of fine Spanish black	at	18	0	—	6	6
16	Yards of frieze —	at	4	6	—	3	12
12	Yards of superfine scarlet	at	18	0	—	10	16
					Sum		

A LINEN DRAPER'S BILL.

Bought of *John Clay*, July 27, 1793.

			s.	d.		£.	s.
26	Ells of dowlas —	at	1	4	*per* ell	1	14
18	Ells of Holland —	at	4	0	—	3	12
12	Ells of Diaper —	at	1	0	—	0	12
12	Damask napkins —	at	2	0	each	1	4
20	Yards of printed linen —	at	2	0	*per* yd.	2	0
10	Yards of Cambric —	at	12	0	—	6	0
10	Yards of Muslin —	at	7	0	—	3	10
14	Yards of canvas —	at	3	4	—	2	6
					Sum		

A GROCER's BILL.

Bought of *Thomas Hartley*, May 29, 1798.

		s.	d.		£.	s.	d.
8 lb. of raiſins of the ſun	at	0	5	*per* lb	0	3	4
5 lb. of Malaga raiſins	at	0	4½	——	0	5	7½
o lb. of currants -	at	0	6½	——	0	5	5
1 lb. of ſugar -	at	0	4½	——	0	4	1½
2 Sugar loaves, wt. 15 lb.	at	0	9	——	0	11	3
3 lb. of rice - -	at	0	3	——	0	3	3
5 lb. of black pepper -	at	1	6	——	0	7	6
o oz. of cloves -	at	0	10	*per* oz.	0	8	4
				Sum			

A CHEESE-MONGER's BILL.

Bought of *Daniel Bridge*, July 27, 1798.

			s.	d.		£.	s.	d.
Glouceſterſhire cheeſes,	wt. 24 lb.	at	0	4	*per* lb.	0	8	0
Warwickſhire ——	wt. 20 lb.	at	0	3	——	0	5	0
Cheſhire ——	wt. 28 lb.	at	0	4	——	0	9	4
Firkin of butter	wt. 28 lb.	at	0	6	——	0	14	0
Flitch of bacon	wt. 6 ſt.	at	4	0	*per* ſt.	1	4	0
lb. of Cambridge butter		at	0	6	*per* lb.	0	3	6
lb. of new cheeſe -		at	0	4	——	0	3	0
lb. of cream cheeſe -		at	0	6	——	0	3	6
					Sum			

A MILLINER's BILL.

Bought of *Jean Innan*, Auguſt 22, 1798.

		s.	d.		£.	s.	d.
Yards of ſilver riband	at	2	3	*per* yd.	1	13	9
Pair of fine kid gloves	at	2	6	*per* pair	0	6	0
Dozen of Iriſh lamb ditto	at	1	0	——	3	12	0
Sarſenet hoods -	at	4	6	each	1	7	0
Fans, Indian mounts	at	4	0	——	3	0	0
Setts of knots -	at	2	0	*per* ſet	0	6	0
Yards of fine lace -	at	10	0	*per* yd	8	0	0
Pieces of bobbin -	at	0	6	*per* piece	0	10	0
				Sum			

A CARPENTER's BILL.

Mr. John Law, Dr. to *John Brooks*, for Carpenter's Wo
and Materials, viz.

1798			s.	d.		£.	s.
May 3	For 30 feet of fir timber,	at	0	3	*per* foot	0	7
5 ——	18 whole deals	at	1	6	each	1	7
——	16 ſlit deals	at	1	0	——	0	16
——	4 Hundred of ſixpenny nails					0	2
——	3 Hundred of tenpenny nails					0	2
——	6 Hundred of brads					0	1
21 ——	18 Day's work	at	3	0	*per* day	2	14
					Sum		

A BAKER'S BILL.

Mr. Thomas Marriott, Dr. to *James Barnet.*

1798		£.	s.
Feb. 4	For a peck of bran	0	0
——	a fine peck loaf	0	1
13 ——	a peck of fine flour	0	1
17 ——	a buſhel of pollard	0	1
18 ——	Small bread	0	0
——	Yeſt	0	0
——	a half peck ſecond loaf	0	0
20 ——	a quartern ſecond loaf	0	0
	Sum		

A BILL OF DISBURSEMENT.

1798		£.	s.
Feb. 17	Laid out in lamb, ſeven groats		
18 ——	in ſalad, five farthings		
21 ——	in beef, ninepence halfpenny		
Mar. 7 ——	in parſnips, three halfpence		
8 ——	in potatoes, a groat		
9 ——	in candles, ſeven groats and three pence		
10 ——	in butter and cheeſe, eight and twenty pence		
12 ——	in bread, three and twenty pence		
	Sum		

		£.	s.	d.
	Suppose I am indebted			
To *A*,	Twenty pounds, seven shillings and four pence farthing - - - -			
— *B*,	Nineteen pounds, thirteen Shillings and tenpence halfpenny - -			
— *C*,	Twelve pounds, fourteen shillings, and sevenpence three farthings -			
— *D*,	Twenty-six pounds, seventeen shillings, and fourpence farthing - -			
— *E*,	Twenty-eight pounds, thirteen shillings, and sevenpence three farthings -			
— *F*,	Twenty-one pounds, fifteen shillings and fivepence halfpenny - -			
— *G*,	Five pounds, six shillings, and sevenpence farthing - - - -			
	How much is the debt? *Sum*			

2. Of TROY WEIGHT.

Q. Which are the denominations of Troy Weight?

A. 24 Grains or *gr.* make 1 Penny weight, *dwt.*
20 Pennyweights —— 1 Ounce, *oz.*
12 Ounces 1 Pound, *lb.*

Q. What sort of things are weighed by this Weight?

A. Gold, Silver, Jewels, Electuaries, and all Liquors.

Q. What is the standard for Gold?

A. 22 Carats of fine Gold, and 2 carats of Copper being melted together, are esteemed the true standard for Gold Coin.

Q. What is a Carat?

A. A Carat is not any certain quantity or weight, but the twenty fourth part of any quantity or weight.

Q. What is the standard for silver?

A. 11 *oz*, 2 *dwts*, of fine silver and 18 *dwts.* of copper being melted together, are esteemed the true standard for silver coin; called silver sterling.

Note. The Ounce of silver being valued at 5 Shillings; one penny-weight will be valued at three pence, and the grain at half a farthing.

EXAMPLES.

Oz.	dwt	gr.
7	10	12
6	11	11
5	16	11
4	17	10
1	12	16
7	12	18
9	16	19
8	14	16
4	16	10
9	4	8

Oz.	dw.	gr.
7	13	12
6	11	14
9	12	17
4	16	13
7	11	14
9	16	12
7	13	16
3	19	14
5	9	8
6	12	13

lb.	oz.	dw.	gr.
4	10	12	11
3	11	16	12
1	4	16	19
3	3	11	17
4	1	16	14
3	3	16	11
7	11	16	10
6	4	13	15
5	11	14	13
9	10	15	14

lb.	oz.	dw.	gr.
7	10	12	10
3	4	16	13
3	7	12	11
1	1	18	16
3	11	16	12
4	3	16	21
3	3	13	11
3	7	18	19
9	8	19	9
9	11	12	8

3. OF AVOIRDUPOIS WEIGHT.

Q. Which are the denominations of Avoirdupois Weight?

A.

16 drams, or *dr.*	make	1 Ounce, *oz.*
16 Ounces	——	1 Pound, *lb.*
28 Pounds	——	1 Quarter of an hundred weight, *qr.*
4 Quarters	——	1 Hundred weight or 112 pounds, *cwt.*
20 hundred wt.	——	1 Ton, *T.*

Q. What is the use of Avoirdupois Weight?

A. Avoirdupois Weight is used in Weighing any thing of a coarse and drossy nature, as all grocery and Chandlers' wares, and all metals, but silver and gold.

Note, Bread formerly was weighed by Troy Weight, but is now at London weighed by this weight.

Q. What is the difference between a Pound Avoirdupois and a Pound Troy.

A. The Pound Avoirdupois is equal to 14 *oz* 11 *dwt.* 15 *gr*. and an half Troy; and the Pound Troy is equal to 13 *oz.* 2 *dr.* and an half, and $\frac{9322}{13999}$ Avoirdupois.

Q. What other denominations are there in this weight?

A. There are several other denominations in Avoirdupois Weight, in some particular goods, and others only customary in some particular places; as appears by the following table.

TABLE.

	lb.
A firkin of butter is	56
—— of ſoap is	64
A barrel of pot-aſh is	200
—— of anchovies is	30
—— of candles is	120
—— figs from to 2 *C.* 3 *qrs.*	98
—— ſoap is	256
—— butter is	224
—— gunpowder is	112
—— raiſins is	112
A double barrel of anchovies is	60
A puncheon of prunes is 10 *C.* or 12 *C.*	
A fother of lead is 19 *C.* 2 *qrs*	
A ſtone of iron or ſhot is	14
—— of butchers' meat is	8
A gallon of train oil is	7½
A faggot of ſteel is	120

	lb.
A burden of gad ſteel, or 9 ſcore	180
A quintal of fiſh in Newfoundland	100
A ſtone of glaſs is	5
A ſeam of glaſs is 24 ſtone, or —	120
For Cheeſe and Butter.	
A clove, or half ſtone is	8
A wey in Suffolk is 32 cloves, or —	256
—— Eſſex is 42 cloves or	336
For Wool.	
A clove is ——	7
A ſtone is ——	14
A tod is ——	28
A wey is 6 tod and 1 ſtone or	182
A ſack is 2 weys, or	364
A laſt is 12 ſacks, or	4368

Examples.

C.	*qr.*	*lb.*	*C.*	*qr.*	*lb.*	*lb.*	*oz.*	*dr.*	*lb.*	*oz.*	*dr.*
11	1	19	17	1	12	14	10	12	12	10	12
12	3	11	17	2	11	16	12	11	17	12	10
4	1	17	14	1	12	19	12	12	14	12	13
1	2	12	16	3	19	17	12	14	16	12	11
11	1	11	19	1	12	14	13	0	20	12	13
3	2	13	16	3	18	16	15	14	20	13	4
2	2	20	12	2	22	23	13	13	24	14	3
5	3	26	19	3	17	27	12	10	22	10	7

4. OF APOTHECARIES' WEIGHT.

Which are the denominations of Apothecaries' Weight?

20 Grains, or *gr.* make 1 Scruple, ℈
3 Scruples —— 1 Dram, ʒ
8 Drams —— 1 Ounce, ℥
12 Ounces —— 1 Pound, ℔.

Q. What is the use of Apothecaries' Weight?

A. Apothecaries' Weight is such as their medicines are compounded by.

Note 1. The apothecaries mix their medicines by this rule, yet buy and sell their commodities by Avoirdupois Weight.

2. The apothecaries' pound and ounce, and the pound and ounce Troy, are the same, only differently divided and subdivided.

EXAMPLES.

℔	℥	ʒ	℈	*gr.*	℔	℥	ʒ	℈	*gr.*	℔	℥	ʒ	℈	*gr.*
3	11	7	2	19	7	1	3	1	10	7	3	2	2	11
2	3	4	1	13	0	1	2	1	14	6	2	7	0	12
0	1	7	2	12	7	3	4	1	12	3	7	2	1	12
1	2	6	2	11	6	1	1	2	11	1	3	1	0	10
2	1	3	1	12	0	0	3	2	17	2	1	2	2	11
1	2	4	0	11	0	1	0	0	10	1	3	1	2	11
7	10	3	1	16	0	1	2	0	10	4	5	1	2	11
1	7	6	1	15	0	3	7	2	19	7	3	2	1	15

5. OF LONG MEASURE.

Q. Which are the denominations of Long Measure?

A. 3	Barley Corns, or *b. c.*	make	1 Inch, *in.*
4	Inches	——	1 Hand, *hd.*
12	Inches	——	1 Foot, *ft.*
3	Feet	——	1 Yard, *yd.*
6	Feet	——	1 Fathom, *fa.*
5	Yards and a half	——	1 Rod, Pole, or Perch, *po.*
40	Poles	——	1 Furlong, *fu.*
8	Furlongs	——	1 Mile, *m.*
3	Miles	——	1 League, l.
60	Miles	——	1 Degree, *deg.*

Note. A degree is 69 miles and 4 furlongs very near, though commonly reckoned but 60 Miles.

Q. What is the use of Long Measure?

A. To measure distances of places, or any thing else where length is considered without regard to the breadth.

Q. Is the pole or perch always of the same length?

A. No. Q. What is the difference?

A. Five yards and a half are the statute measure for a pole or perch; but for fens and woodlands it is customary to reckon 18 feet to the pole; and for forests 21 feet.

Q. What is the use of a Hand?
A. It is used to measure horses.
Q. What is the use of a Fathom?
A. It is used to measure depths.

Examples.

M.	*fu*	*p.*	*Yds.*	*f.*	*in.*	*L.*	*m.*	*fu.*	*p*	*Yds.*	*f.*	*in.*	*b.c.*
17	7	19	14	2	7	17	2	6	14	16	1	0	0
16	1	14	16	1	4	12	1	2	18	14	2	10	1
19	3	16	19	1	10	16	2	1	16	17	1	4	2
17	4	19	16	2	4	19	2	7	11	13	2	11	1
12	1	11	14	2	5	19	0	4	31	16	1	7	2
18	3	16	14	2	1	17	1	1	12	17	1	4	1
19	7	14	11	1	3	12	2	1	17	19	2	6	2
16	6	26	11	0	1	12	1	1	14	19	2	1	2

6. Of CLOTH MEASURE.

Q. Which are the denominations of Cloth Measure?

A. 2 Inches, or *in.* and a quarter make 1 Nail, *n.*
4 Nails ——— ——— 1 Qr. of a Yd. *qr.*
4 Quarters — ——— 1 Yard, *yd.*
3 Quarters of a Yard ——— 1 Flemish Ell. *FE*
5 Quarters of a Yard ——— 1 English Ell, *E.*

Note, 1. The yard is used in measuring all sorts of woollen cloths, wrought silks, most linens tape, and gartering.
2. The ell English is used in measuring some particular linens called Hollands.
3. The ell Flemish is used in measuring tapestry.

Examples.

Yds.	*qrs.*	*na.*	*Ells*	*qrs.*	*na.*	*Yds*	*qrs.*	*na*	*E F.*	*qrs.*	*na.*
17	1	1	14	1	2	17	2	1	17	1	2
11	3	1	17	3	1	16	3	3	17	1	3
16	1	2	14	3	1	17	1	2	14	1	2
29	3	1	16	3	2	19	2	1	19	2	0
17	1	2	19	1	1	17	3	3	14	0	0
11	3	3	19	2	3	16	1	2	19	2	1
19	1	1	16	3	1	19	2	1	17	2	2
14	2	3	15	1	2	17	1	2	16	1	3

7. Of LAND MEASURE.

Q. Which are the denominations of Land Measure?

A. 9 Square feet, or *ft.*	make	1	Yard, *yd.*
30 Yards and a quarter	——	1	Pole, *po.*
40 Poles in length and 1 in breadth		1	Rood, *r.*
4 Roods	—— ——	1	Acre, *a.*

Q. What is the use of Land Measure?

A. It gives the content of any piece of ground in acres.

Examples.

A.	*r.*	*p.*	*A.*	*r.*	*p.*	*A.*	*r.*	*p.*
17	3	12	17	1	12	26	1	36
12	2	14	14	2	13	13	2	23
15	1	22	15	3	27	23	3	22
16	2	12	19	1	23	36	2	13
17	2	27	12	2	16	22	2	28
13	2	23	16	3	24	29	0	33
12	1	17	7	1	12	33	3	16
15	3	21	12	3	14	27	2	24

8. Of LIQUID MEASURE.

Q. How many sorts of Liquid Measure are there?

A. Two; Wine Measure and Winchester Measure.

Q. What is meant by Winchester Measure?

A. It is a particular measure used for beer and ale.

Q. What is the difference between Wine Measure and Winchester Measure?

A. A gallon of wine is 231 solid inches; but a gallon of beer or ale exceeds that measure by 51 inches; and is 282 solid inches.

(1.) *Of Wine Measure.*

Q. Which are the denominations of Wine Measure?

A. 2	Pints, or *pts.*	make	1	Quart, *qt.*
4	Quarts	——	1	Gallon, *gal.*
10	Gallons	——	1	Anchor of brandy or rum, *an*
18	Gallons	——	1	Runlet, *R.*
$31\frac{1}{2}$	Gallons	——	1	Barrel, *bar.*
42	Gallons	——	1	Tierce, *T.*
63	Gallons	——	1	Hogshead, *hhd.*
84	Gallons	——	1	Puncheon, *pun.*
2	Hogsheads	——	1	Pipe or butt, *p.*
2	Pipes or 4 hogsheads		1	Ton, *T.*

Q. What other liquors are measured by the Wine Standard?

A. All Brandies, Spirits, Strong Waters, Perry, Cider, Mead, Vinegar, Honey and Oil.

Note, Milk is also retailed by this standard, not by law, but by custom only.

EXAMPLES.

T.hhds.	*gal.*	*qts.*	*Hhds.*	*gal.*	*qts.*	*Tier.*	*gal.*	*qts.*
7 1	12	2	27	10	2	27	12	1
6 3	31	3	22	13	3	29	17	3
7 1	41	3	26	11	3	22	11	2
6 2	17	1	29	12	2	27	31	3
7 3	14	3	23	22	0	29	12	1
1 1	19	1	27	32	2	17	11	2
9 1	15	2	29	27	3	26	17	1
3 2	11	2	26	33	2	22	14	3

(2.) *Of Winchester Measure.*

Q. Which are the denominations of Winchester Measure?

A. 2 Pints or *pts.* ——— make 1 Quart, *qt.*
4 Quarts — ——— 1 Gallon, *gal.*
8 Gallons — ——— 1 Firkin of ale, *fir.*
9 Gallons — ——— 1 Firkin of beer, *fir.*
2 Firkins — ——— 1 Kilderkin, *kil.*
4 Firkins — ——— 1 Barrel, *bar.*
Barrel and a half, or 54 gallons 1 Hogshead of beer, *hhd.*

Q. What is the difference between ale and beer Measure?

A. In London only they compute 8 gallons to the firkin ale, and 32 gallons to the barrel: but in all other parts England, for ale, strong beer, and small beer, 34 gallons computed to the barrel, and 8 gallons and an half to e firkin.

Q. What other commodities are there that go by the Winchester Measure?

A. A Barrel of salmon or eels is 42 Gallons.
A Barrel of herrings — 32 Gallons.
A Keg of sturgeon — 4 or 5 Gallons
A Firkin of soap — 8 Gallons.

Examples.

Hhds.	*gal.*	*qts.*	*B.B*	*fir.*	*gal.*	*Hhds.*	*gals.*	*qts.*	*A B*	*fir.*	*gal.*
7	12	1	23	3	3	26	17	1	23	1	7
6	27	2	27	2	6	13	19	2	24	2	6
3	21	2	29	3	7	21	16	3	27	1	5
2	11	1	27	2	8	31	18	2	27	3	4
3	17	2	26	1	5	27	10	1	26	3	2
2	12	1	37	1	4	31	18	2	27	1	3
6	17	3	27	1	3	26	31	1	26	2	1
7	41	2	32	1	2	31	26	2	27	1	0

9. Of DRY MEASURE.

Q. Which are the uſual denominations of Dry Meaſure?

A. 2 Pints, or *pts.*	make	1 Quart, *qt.*
2 Quarts	——	1 Pottle, *pot.*
2 Pottles	——	1 Gallon, *gal.*
2 Gallons	——	1 Peck, *p*
4 Pecks	——	1 Buſhel, *buſh.*
8 Buſhels	——	1 Quarter of corn, *qr.*
36 Buſhels	——	1 Chaldron of coals, *ch.*

Q. Wherein does London differ from other places in England, in the Coal Meaſure?

A In London 36 buſhels make a chaldron; but in all other places 32 buſhels make a chaldron. The buſhel alſo in Water Meaſure contains 5 pecks.

Q. What other denominations are there in Dry Meaſure?

A. A Score of Coals	is	21 Chaldrons.
A Sack of Coals	—	3 Buſhels.
A Sack of Corn	—	4 Buſhels.
10 Quarters of Corn	make	1 Wey.
12 Weys	——	1 Laſt.
A Load of Corn	——	5 Buſhels.
A Cart load ditto	——	40 Buſhels.

Q. What is the uſe of Dry Meaſure?

A. Dry Meaſure is applied to all dry goods, as Corn, Seeds, Fruits, Roots, Sand, Salt, Sea-Coal, Charcoal, Small-coal, Oyſters, Muſcles, and Cockles.

Q. What is the ſtandard for Dry Meaſure?

A. The Standard for Dry Meaſure is a Wincheſter buſhel, being 18 inches and a half wide throughout, and 8 Inches deep. One gallon of this quantity is 268 ſolid Inches and $\frac{4}{10}$, and conſequently is leſs than an ale gallon by 13 ſolid Inches and $\frac{2}{5}$.

Examples.

Ch.	*bu.*	*p.*	*Qrs.*	*bu.*	*p.*	*Ch.*	*bu.*	*p.*	*Qrs.*	*bu.*	*p.*
17	11	3	14	7	2	27	10	1	36	7	3
16	10	2	24	1	1	27	20	2	36	6	3
19	11	1	26	3	2	17	12	1	43	3	2
17	11	3	19	1	1	24	22	2	22	3	3
16	19	3	16	3	2	32	35	3	36	5	2
17	10	1	17	1	1	72	26	2	28	4	2
17	12	3	12	3	1	55	12	3	33	7	0
15	14	1	37	2	3	27	14	1	46	3	2

10. Of TIME.

Q. Which are the denominations of Time?

A. 60 Seconds, or *ſec.* make 1 Minute, *min.*
60 Minutes —— 1 Hour, *hr.*
24 Hours —— 1 Day, *da.*
7 Days —— 1 Week, *wk.*
4 Weeks —— 1 Month, *mo.*
13 Months, 1 day and 6 hours a common or Julian year, *yr.*

Q. What is a Solar year?

A. According to the beſt computation, a Solar Year is 365 days, 5 hours, 48 minutes, and 55 ſeconds.

Q. How is the year divided by the Calendar?

A. No more days than 30 hath th' month of September,
The ſame may be ſaid of June; April, November,
The reſt of the months have juſt 30 and one,
Except that ſhort month February alone,
Which to itſelf claimeth juſt 8 and a ſcore,
But in ev'ry Leap Year we give it one more.

EXAMPLES.

M.	*w.*	*d.*	*H.*	*m.*	*ſec.*	*M.*	*w.*	*d.*	*D.*	*h.*	*m.*	*ſec.*
14	1	6	17	10	32	31	2	1	17	11	12	16
17	2	5	17	22	21	17	1	6	19	12	16	11
16	1	3	25	10	35	31	2	5	17	11	12	16
19	2	2	4	22	3	17	1	6	13	12	26	35
25	1	1	7	21	1	16	3	4	25	12	14	58
26	3	0	73	3	30	27	1	1	17	19	25	47
12	2	2	22	28	42	29	2	5	13	23	26	51

OF MOTION.

Q. Which are the denominations of motion in the heavenly bodies?

A. 60 Seconds or ″ make 1 Prime minute ′.
60 Minutes —— 1 Degree °.
30 Degrees —— 1 Sign
12 Signs, or 360 degrees, make the whole great circle of the Zodiac.

Examples.

°	′	″	°	′	″	°	′	″
71	10	16	47	17	19	46	17	33
12	11	19	17	10	38	17	36	18
17	16	13	12	11	41	13	15	12
19	15	26	13	10	16	16	19	14
17	48	55	26	17	12	17	12	10
14	35	12	73	19	12	15	15	10
17	26	24	16	41	32	17	19	17
15	16	17	21	22	41	31	26	43

12. Of Things bought and sold by the Tale.

Q. Which are the denominations of things accounted by the Tale?

A. 12 particulars make 1 Dozen.
12 Dozen —— 1 Gross.
12 Gross or 144 dozen 1 great Gross.

Examples are needless.

Questions to exercise ADDITION.

1. A man was born in the year 1798, I demand when he will be 57 years of age?

2. There are two numbers whose difference is 17, and the lesser number is 44—what is the greater number?

3. A man borrowed a sum of money, and paid in part, 12*l.* 10*s.* and the remainder is 17*l.* 10*s.*—I demand the sum borrowed?

4. *A* owes me three guineas, *B* 50*l.* 12*s.* *C* 104*l.* *D* threescore and seventeen pounds—how much is due to me in all?

5. *A*, *B*, and *C* bought a parcel of goods, in the purchase of which *A* laid out 3*l.* *B* 40*s.* and *C* 20*d.*—how much was laid out in all?

6. A man hath 6 bags of hops; the first weighs 2 *qrs.* 14 *lb.* and each of the rest weighs 14 *lb.* more—what quantity hath he in the whole?

7. A man took an house for 12 years; and by agreement was to pay 100*l.* 10*s* down; 190*l.* 4*s* at the end of 6 years, and 109*l* 6*s.* at the end of 12 years – I demand the whole sum?

8 A shopkeeper having opened a shop, the first week sold goods to the value of threescore pounds, the next week he took fourscore pounds; but the third week he took no more than thirty shillings—how much did he receive in all?

Of SUBTRACTION.

Q. WHAT is the use of Subtraction?

A. By taking a less number from a greater, it shews the difference between both.

Q. How many sorts of Subtraction are there?

A. Two; Simple and Compound.

Of Simple Subtraction.

Q. What is Simple Subtraction?

A. Simple or Single Subtraction is the finding a difference between any two numbers whose signification is the same; as the difference between 6 yards and 4 yards is 2 yards.

Q. How are numbers to be placed in Subtraction?

A. With units under units, tens under tens, &c as in Addition.

Q. What rule have you for the operation of Subtraction in general?

A. When the lower number is greater than the upper, take the lower number from the number which you borrow, add to that difference and the upper number, carrying one to the next lower place.

Q. What number must you borrow, when the lower number is greater?

A. The same which you stop at in Addition.

Q. How do you prove Subtraction?

A. By adding the remainder and the lesser line together, which will always be equal to the greater line. Or, By subtracting the remainder from the greater line, and that difference will always be equal to the lesser line.

Examples.

	£.	*Yards.*	*Miles.*	*Days.*	*Months.*
From	763	7694	41372	761214	761347
Take	122	1867	13976	121812	28131
Diff.					

	Hours.	*lb.*	*Crowns.*	*Months.*
From	31261812	312617127	7116871	761264
Take	19879428	163121712	26571014	591092
Diff.				

Of Compound Subtraction.

Q. What is Compound Subtraction?

A. Compound Subtraction produces a difference betwe[en] any sums of divers denominations?

Of MONEY.

Examples.

	£. s. d.	£. s. d.	£. s. d.	£. s. d.
From	13 10 $6\frac{1}{2}$	36 12 $6\frac{1}{2}$	76 12 $6\frac{3}{4}$	31 18
Take	3 17 $8\frac{1}{2}$	17 12 $2\frac{1}{4}$	27 13 $3\frac{1}{4}$	16 19
Diff.				

	£. s. d.	£. s. d.	£. s. d.	£. s.
Borr.	41 15 3	76 12 $4\frac{1}{2}$	73 7 6	17 12
Paid	19 17 $1\frac{1}{2}$	13 17 7	19 4 $1\frac{1}{2}$	14 7
Unpd.				

	£. s. d.	£. s. d.	£. s. d.	£. s.
Lent	137 11 $6\frac{1}{2}$	47 17 6	413 11 $7\frac{1}{4}$	17 18
Rec.	76 12 $7\frac{1}{4}$	29 11 $6\frac{1}{2}$	171 18 $9\frac{1}{2}$	17 16
Due				

EXAMPLES.

	£.	s.	d.		£.	s.	d.
Borrowed	764	0	0	*Lent*	800	10	6
Paid at several times	13	1	1½	*Received at several times*	12	11	2¼
	17	4	2		19	12	6
	16	1	6¼		17	11	2½
	21	2	1		14	11	3
	19	11	10		19	12	2
	26	13	5¼		14	11	8¼
	11	19	6½		17	16	2¼
	13	12	2½		46	12	7¾
Paid in all				*Received in all*			
Unpaid				*Remains due*			

2. OF TROY WEIGHT.

	Oz.	dwt	gr.	Oz.	dwt	gr.	Oz	dwt	gr.	lb.	oz.	dwt	gr.
From	71	11	12	71	12	18	13	16	12	84	4	11	12
Take	2	10	19	10	4	19	5	19	14	17	10	11	7
Diff.													

3 OF AVOIRDUPOIS WEIGHT.

	C	qrs.	lb.	lb	oz	dr.	lb.	oz.	dr.	T.	C	qr.	lb.
Bought	72	1	18	17	2	1	17	10	1	12	1	2	10
Sold	3	1	26	10	13	2	15	14	3	5	3	1	19
Unsold													

4. OF APOTHECARIES' WEIGHT.

	℥	ʒ	℈	gr.	℥	ʒ	℈	gr.	℔	℥	ʒ	℈	gr.
From	65	4	2	10	47	5	1	16	48	2	2	0	19
Take	7	6	2	12	2	1	2	18	10	1	2	2	17
Diff.													

5. LONG MEASURE.

	L.	m.	f.	p.	Yd.	f.	in.	b.c.	L.	m.	fu.
From	71	1	3	10	40	0	3	2	61	0	1
Take	14	2	5	16	11	0	1	1	19	1	2
Diff.											

6. CLOTH MEASURE.

	Yds.	qr	na.	E.F.	qr.	na.
Bou.	71	3	1	51	2	2
Sold	14	2	3	16	1	3
Unsold						

	Yds.	qr.
A Draper bought	148	0
Sold at several times	14	1
	17	3
	19	1
	16	2
	17	3
Sold in all		
Unsold		

	Yds.	qr.	na.	E.F.	qr.	na.
From	47	2	1	17	2	2
Take	12	1	3	14	4	3
Diff.						

7. LAND MEASURE.

	A.	r.	p.	A.	r.	p.	A.	r.	p.	A.	r.
Bought	12	1	10	17	3	17	38	1	7	32	0
Tilled	5	3	17	12	3	23	19	1	28	16	2
Untilled											

8. WINE MEASURE.

	T.	hhds.	gal.	T.	hhds.	gal.	Gal.	qts.	pts.	Gal.	qts.
From	3	2	10	7	2	10	19	2	1	67	1
Take	1	3	19	1	2	28	12	1	1	12	3
Diff.											

9. WINCHESTER MEASURE.

	Hhds.	gal.	qts.	A.B.	f.	gal.	B.B.	f.	gal.	Hhds.	gal.	qts.
u.	17	10	1	17	2	1	48	1	3	41	2	2
d	12	11	2	14	1	3	17	1	7	23	3	3

10. DRY MEASURE.

	Ch.	bu.	p.	Ch.	bu.	p.	Qrs.	bu.	p.	Qrs.	bu.	p.
m	17	2	1	40	1	2	19	1	1	26	1	3
ke	10	1	3	16	5	1	12	7	2	19	1	2

11. TIME.

	D.	h.	m.	ſec.	W.	d.	h.	m.	ſec.	W.	d.	h.	m	ſec.
m	41	13	22	12	14	1	10	12	10	17	1	10	12	10
e.	22	16	33	31	10	3	19	48	26	10	2	14	6	15

12. MOTION.

	°	′	″	°	′	″	°	′	″
n	48	10	12	47	2	10	62	13	9
e	19	11	16	12	19	46	49	18	33

QUESTIONS to exerciſe SUBTRACTION.

A man was born in the year 1702,—I demand his age e year 1798 ?

There are two numbers, the greater number is 61, he leſſer number is 44,—I demand the difference ?

There are two numbers, whoſe difference is 17, and reater number is 61,—I demand the leſſer number ?

The brewer and the baker drew bills each upon the other, rewer ſtands indebted 45l. 19s. and the baker 26l. and —who is the proper perſon indebted, and how much ?

E 2

5. A man borrowed 30l and paid in part 12l. 10s — I demand how much remains unpaid?

6. King Charles the martyr was beheaded in the year 1648—how many years is it since?

7. *A.* is indebted to the brewer the sum of 109l 10s, owes him 94l 4s. 10½d. how much does one owe more than the other?

8. What sum is that which taken from 100l. leaves 4 17s. 6¼d?

9 There were 4 bags of Money, containing as follows, viz. The first bag 24l the second bag 50l the third bag 10 and the fourth bag 150l. which were to be paid to several persons; but one of the bags being lost, there were but 23 paid—I demand which bag was wanting?

Of MULTIPLICATION.

Q, WHAT is Multiplication?

A. It is the short way of performing several Additions.

Q. How many parts are there in Multiplication?

A Three, *viz.*

1. The Multiplicand, or sum to be multiplied.
2. The Multiplier, or sum multiplied by.
3. The Product, or total of the multiplicand, as often as there are units in the multiplier.

Note The Multiplicand and the Multiplier are also called Factors, and the Product the Factor's Rectangle

Q. How many sorts of Multiplication are there?

A. Two, *viz.* Simple and Compound.

Of Simple Multiplication.

Q. What is Simple Multiplication?

A. Simple Multiplication is the multiplying of any two numbers together, without respect to their signification; as 7 times 8 is 56.

Note, 1. As Addition and Subtraction of Integers are called Simple Addition and Simple Subtraction; so should Multiplication and Division of Integers be called Simple Multiplication and Simple Division; and that only should be called Compound Multiplication and Compound Division, which hath numbers of divers denominations to be either multiplied, or divided.

2, The following table must be learned perfectly by heart, before you can proceed any farther

MULTIPLICATION TABLE.

2 times	2 is	4
	3	6
	4	8
	5	10
	6	12
	7	14
	8	16
	9	18
	10	20
	11	22
	12	24
3 times	3	9
	4	12
	5	15
	6	18
	7	21
	8	24
	9	27
	10	30
	11	33
	12	36
4 times	4	16
	5	20
	6	24
	7	28
	8	32
	9	36
	10	40
	11	44
	12	48
5 times	5	25
	6	30
	7	35
	8	40
	9	45
	10	50
	11	55
	12	60
6 times	6	36
	7	42
	8	48
	9	54
	10	60
	11	66
	12	72
7 times	7	49
	8	56
	9	63
	10	70
	11	77
	12	84
8 times	8	64
	9	72
	10	80
	11	88
	12	96
9 times	9	81
	10	90
	11	99
	12	108
10 times	10	100
	11	110
	12	120
11 times	11	121
	12	132
12 times	12	144

Case I.

Q. What do you observe in the first case of multiplication?

A. That the factors be placed one under another, in such manner that units may stand under units, tens under tens, &c. and then multiply as the table directs.

Examples.

£.	*Crowns*	*Days.*	*Hours.*
47613127	47613174	71261812	[illegible]
2	3	4	5

Minutes.	*Years*	*Gallons.*	*Ounces.*
74126184	71312674	31267126	47611312
6	7	8	9

CASE II.

Q. What do you observe in the second case of Multiplication?

A. 1. When the multiplier consists of more figures than one, there must be made as many several products, as there are figures contained in the multiplier.

2. Let the first figure of every product be placed exactly under its multiplier

3 Add these products together, and their sum will be the total product.

Q How do you prove Multiplication ?

A. Multiplication and Division do mutually prove each other ; yet Multiplication may as truly be proved by itself, by inverting the factors

EXAMPLES.

Crowns.	*Days*	*Weeks.*	*Pence.*
691861	129186	281216	181281
26	98	978	763
17988386	12660228	275029248	138317403

Ounces.	*Yards.*	*Pints.*	*Quarts.*
269181	261986	812617	281691
4629	7638	43859	76286
1246038849	2001049068	35640569003	21489079626

Q. What exceptions have you to this case ?

A. 1, When these figures 1 and 1, or 1 and 2 happen together in the multiplier, you may multiply by both at once, as in CASE I.

Examples.

Weeks.	*Bushels.*	*Grains.*	*Leagues.*
761312	671612	963458	843126
412	114	912	119
313660544	76563768	878673696	100331994

2. When any other number between 12 and 20 happens, as 13 14, 15, &c then multiply by the figures in the unit's Place, and as you multiply, add to the product of each single figure that of the multiplicand, which stands next on the right hand.

Examples.

Gallons.	Days.	Months.	lb.
4721217	4713176	4631261	4713761
15	16	17	18

Caſe III.

Q. What do you obſerve in the third caſe of Multiplication?

A. 1 Such Factors as have cyphers at the ends, muſt be ſet one under another, as if there were no cyphers.

2. The cyphers placed at the end of either or both of the factors, are to be omitted till the laſt product, and then the ſame number of cyphers muſt be annexed to it.

Examples.

Pence.	Hours.	Years.
476000	180120	461210
170	48100	81900
80920000	8663772000	37773099000

Nails.	Inches.	Barrels.
760000	461200	618010
4800	72000	74210
3648000000	33206400000	45862522100

Case IV.

Q. What do you obſerve in the fourth caſe of Multiplication?

A. When cyphers are placed between the ſignificant figures in the multiplier, they muſt be omitted in the operation: regard being had to the firſt figure of every particular product as before.

Examples.

Gallons.	Eggs.	Buttons.
128121	128128	246145
72001	70043	70012
9224840121	897469504	14771653740

CASE V.

Q. How do you multiply by the parts of any number instead of the whole?

A. When the multiplier is such a number, that any two figures being multiplied together will make the said multiplier, it is shorter to multiply the given number by one of those figures, and that product by the other as 5 times 7 is 35.

Examples.

Pounds.	*Men.*	*Soldiers.*	*Sailors.*
764126	764131	461231	46131
35	48	72	3
26744410	36678288	33208632	1660723

Of Compound Multiplication.

Q. What is Compound Multiplication?

A. When several numbers of divers denominations are given to be multiplied by one common multiplier, this is called compound multiplication.

£.	*s.*	*d.*	*lb.*	*oz*	*dwt.*	*gr.*	*C.*	*qrs.*	*lb.*	*lb.*	*oz.*	*dr*
17	3	$1\frac{1}{4}$	17	5	12	16	43	1	14	17	12	1
		2				3			4			

M.	*f.*	*p.*	*Yds.*	*f.*	*in.*	*b.c.*	*Yds.*	*qrs.*	*na.*	*B B.*	*fir.*	*ga*
16	4	21	17	2	3	1	16	3	2	17	2	
		6				7			8			

Ch.	*b.*	*p.*	*M.*	*w.*	*d.*	*D.*	*h.*	*min.*	*sec.*	°	′
16	12	3	16	3	4	17	14	14	15	16	11
		10			11				12		

Note, If the learner be taught to turn back to the bills of parcels in Addition, he will find plenty of Examples in Compound Multiplication.

Questions to exercise Multiplication.

1. If one man's pay be 3s. what must 40 men have?

2. What is the product of 76 multiplied by 3 and by 7?

3. There are 124 men employed to finish a piece of work, and they are to have 3l. each man; I demand how much they must all have?

4. An army of 10000 men having pluudered a city, took so much money, that when it was shared among them, each man had 27l. I demand how much money was taken in all?

5. There were 40 men concerned in the payment of a sum of money, and each man paid 1271l. how much was paid in all?

6. If one foot contains 12 inches, I demand how many inches there are in 126 feet?

7. What is the product of 769 multiplied by 9 and 7?

OF DIVISION.

Q. WHAT is Division?

A. It is a short way of performing several subtractions, and shews how often one number is contained in another, and what remains.

Q. How many parts are there in Division?

A. Four, viz.

1. The DIVIDEND, or sum to be divided.
2. The DIVISOR or sum divided by.
3. The QUOTIENT, or answer to the question.
4. The REMAINDER, which is always less than the divisor, and of the same name with the dividend.

Note, The divisor, dividend, and quotient are certain: but the remainder is uncertain, because some operations in division have no remainder.

Q. How many sorts of Division are there?

A. Two; Simple and Compound.

Of Simple Division.

Q. What is Simple Division,

A. Simple Division is when the divisor and dividend are made choice of, without any regard to their signification; as 56 divided by 7 gives 8 for the quotient; or the number 7 is contained in 56 eight times.

Q. How many sorts of Simple Division are there?

A. Two; short division and long division.

Of Short Division.

Q. What is Short Division?

A. Short Division is, when the divisor does not exceed 12

Examples.

Minutes.	*Months.*	*Days.*
2)71313674(	6)312610041(	11)7312013197(
3)42310812(	7)712126719(	12)3812717314(
4)13812612(	8)701267131(	11)1612798131(
5)65231281(	9)126713108(	12)1731261712(

Q. How is Division proved ?

A. Multiply the divisor and quotient together, and the remainder (if there be any) add to the product ; that sum will be equal to the dividend.

Of Long Division.

Case I.

Q. What is Long division ?

A. When the divisor is more than 12, for the help of the memory, we are obliged to multiply the quotient figure and divisor together, and subtract that product from the dividend in order to find out the remainder; which operation must be continued to every quotient figure; And this is called Long Division.

Examples.

Yards.	*Shillings.*	*Pence.*
91)72265871(	28)71261714(	1217)31917312(
82)31712617(	19)91116171(	3164)10697826(
73)17311618(	381)13261714(	6128)71217382(
94)47312617(	773)31746173(	2912)17161231(
55)73181061(	937)13189714(	3318)91261854(
46)76131714(	761)12816171(	71216)17138716(
37)31231712(	7618)18917312(	86257)34175362(

Case II.

Q. What do you observe of cyphers placed at the end of the divisor ?

A. They must be cut off; and the same places also must be cut off in the dividend.

2. Those figures which are cut off in the dividend, must be annexed to the remainder at last.

Examples.

Yards.	*Crowns.*
725|00)712613|12(	128|000)71116|071(
426|00)713126|74(	412|000)71613|181(

Case III.

How do you divide by the parts of any number instead of the whole?

A. When the divisor is of such a number that any two figures being multiplied together, will make the said divisor, it is shorter to divide the given numbers by one of those figures, and that quotient by the other, as 5 times 7 is 35.

Examples.

Pence.	*Crowns.*	*Pounds.*
35)267444l0(	48)36668288(	72)33208652(

Of Compound Division.

Q. What is Compound Division?

A. When several numbers of divers denominations are given to be divided by one common divisor; this is called Compound Division.

Examples.

l.	*s.*	*d.*	*lb.*	*oz.* *dwt.*	*gr.*		*T.*	*C.*	*qr.*	*lb.*	
)48	12	6½(	3)14	10 3	10(		4)17	1	1	14(	
lb.	*oz*	*dr.*	*M.*	*f.*	*p.*		*Yds.*	*f.*	*in.*	*b.c.*	
)46	12	10(	6)38	2	14		7)46	0	10	2(	
Yds.	*qrs.*	*na.*	*A.B.*	*fir.*	*gal.*		*Ch.*	*bu.*	*p.*		
)16	2	2(	9)17	13	2(		10)20	13	2(		
M.	*w.*	*a.*	*D.*	*h.*	*m.*	*sec.*	°	′	″		
)48	2	2(	12)46	16	12	30(	12)33	4	11(		

Questions to exercise Division.

1. If 140s be divided amongst 40 men how much apiece?
2. If 1596 be divided by 21, what is the quotient?
3. There are 124 men who have 372l. among them, how much must each man have?
4. An army of 10000 men having plundered a city took ,666,000l. how much must each man have?
5. There was a certain number of men concerned in the payment of 1272l. and each man paid 3l. I demand the number of men?
6. What is the quotient of 48447, divided by 9 and by 7?
7. If 3264 be divided by 12 and by 4, what is the quotient?
8. A certain man intended to go a journey of about 3264 miles, would complete the same in 136 days, I demand how many miles he must travel each day?

Of REDUCTION.

Q. WHAT is Reduction?

A. Reduction is the bringing or reducing numbers of one denomination into other numbers of another denomination, but of the same value.

Q. How are denominations of any kind reduced from one to another?

A. By Multiplication and Division.

Q. When is Multiplication to be used?

A. When great names are to be brought into small; as pounds into shillings, or days into hours, and this is called Reduction Descending.

Q. When is division to be used?

A. When small names are to be brought into great; as shillings into pounds, or hours, into days, and this is called (though improperly) Reduction Ascending.

Note. Whether you multiply or divide, it must be by as many of the less as make one of the greater denomination.

Q. How are questions in Reduction proved?

A. By varying the order of them.

Of MONEY.

Of Reduction Descending.

1. In 46l. how many shillings and pence?

Ans. 920s.; 11040d.

$$\begin{array}{r} 46l. \\ 20 \\ \hline 920s. \\ 12 \\ \hline 11040d. \\ \hline \end{array}$$

2. In 7l. how many shillings and pence?

Ans. 140s,; 1680d.

3. In 9l, how many Shillings, pence and farthings?

Ans. 180s.; 2160d, 8640 qrs.

4 In 7l. 14s 6¼d, how many farthings?

Ans. 7417. qrs.

5 Reduce 46l 14s. 9¾d. into *qrs.* *Facit* 44871 qrs.

6. Reduce 50l. 9s. 9½d, into half-pence.

Facit 24235 *halfpence.*

7 Reduce 160l. 15s. 6d. into sixpences.

Facit 6431 *sixpences.*

Reduce 48l. 12s. 8d into groats. *Facit* 2918 *groats*.

Reduce 90l. 17s. 6d. into twopences.

Facit 10905 *twopences*.

10. In 12 crowns how many shillings and pence?

Ans. 60s.; 720d.

11. In 15l. how many crowns and shillings?

Ans. 60 *cr*; 300s.

12. In 50 half crowns, how many pence and farthings?

Ans. 1500*d.* 6000 *qrs.*

13. In 306 crowns how many half crowns and pence?

Ans. 612 *half-cr*; 18360*d*

14. Reduce 120 sixpences into threepences, pence, and farthings *Facit* 240 *threepences*; 720*d*, 9880 *qrs.*

15. Reduce 210 crowns, into shillings, groats and pence.

Facit 1050*s.*; 3150 *groats*; 12600*d.*

16. Reduce 86 pounds into crowns, shillings and groats.

Facit 344 *cr.*; 1720*s.*; 5160 *groats*.

17 How many shillings and pence are in 17 guineas?

Ans. 357*s.*; 4284*d.*

18. How many crowns, and sixpences are in 28l

Ans. 112 *crowns*; 1120 *sixpences*

Reduction Ascending.

1. In 11040d, how many shillings and pounds?

Ans. 920*s.*; 46*l.*

2|0

12)11040(92|0=46l.

2. In 1680d. how many Shillings and pounds?

Ans. 140*s.*; 7*l.*

3. In 8640 qrs. how many pence, shillings and pounds?

Ans. 2160*d.*; 180*s*: 9*l.*

4 In 7417 qrs how many pounds? *Ans.* £ 7 : 14 : 6¼

5. Reduce 44871 qrs. into pounds *Facit* £46 : 14 : 9¾

6. Reduce 24235 halfpence into pounds.

Facit £50 : 9 : 9½

7. Reduce 6431 sixpences into pounds. *Facit* £160 : 15 : 6

8. Reduce 2918 groats into pounds. *Facit* £48 : 12 : 8

9. Reduce 10905 twopences into pounds

Facit £90 : 17 : 6

10. In 720d. how many shillings and crowns?

Ans 60*s* : 12 *cr.*

11. In 300s. how many crowns and pounds?

Ans. 60 *cr.* : 15*l.*

12. In 6000 qrs. how many pence and half crowns?

Ans. 1500*d.*; 50 *half-crowns*.

13. In 18360d. how many half-crowns and crowns?
Ans. 612 *half-cr*; 306 *c*

14. Reduce 2880 qrs. into pence, threepences, and fi pences. *Facit* 720*d.*; 240 *threepences*; 120 *sixpence*

15. Reduce 12600d. into groats, shillings, and crowns.
Facit 3150 *gr.*; 1050*s.*; 210 *c*

16. Reduce 5160 groats into shillings, crowns and pound
Facit 1720*s*; 344 *cr.*; 86

17. How many shillings and guineas are in 4284 pence?
Ans. 357*s.*; 17 *guinea*

18. How many crowns and pounds are in 1120 sixpences
Ans 112 *cr.*; 28

Reduction Ascending and Descending.

1. In 720 shillings, how many pence and crowns?
Ans. 8640*d.*; 144 *crown*

720s.
12

6|0)864|0(144

2. In 120 shillings, how many crowns and half crowns?
Ans. 24 *crowns*; 48 *half-crown*

3. In 60 crowns how many shillings and pounds?
Ans. 300*s.*; 1

4. In 612 half-crowns, how many crowns and pence?
Ans. 306 *crowns*; 1836o

5. In 40 guineas, how many shillings, crowns, and pounds
Ans. 840*s*; 168 *cr.*; 42

6. Reduce 12600 pence into shillings, groats, and pounds
Facit. 1050*s.* 3150 *gr.*; 210 *c*

7. Reduce 63 crowns into shillings and guineas?
Facit 315*s.*; 15 *guinea*

8. Reduce 70 moidores into pounds? *Facit* 94*l.*; 10

9. Reduce 12180 threepences into shillings, pence an groats? *Facit* 3045*s.*; 36540*d.* 9135 *gr*

10. How many crowns, groats and pounds are in 1720s
Ans. 344 *cr.*; 5160 *gro.*; 86

11. How many groats, threepences and sixpences are in 12 shillings? *Ans.* 363 *gro.*; 484 *threepences*; 242 *sixpence*

12. How many pounds and crowns are in 1120 sixpence
Ans. 28*l.*; 112 *c*

13. How many crowns, half-crowns, and shillings are i 280l. and the number of each equal?
Ans. 658, and 7*s.* ove

14. Four men brought each 17l. 10s. value in gold into e mint to be coined into guineas,—how many must they ve? *Ans.* 66 *guin.* 14*s.*

15. There are 12 purses with each 12 guineas,—how ich sterling is the sum? *Ans.* £151 : 4*s.*

16. A certain ground-tenant was behind with his land-d for 16 years rent, at 5l. 10s. a year,—how much was e debt? *Ans.* £88.

17. There are 34l. 17s. to be divided amongst 17 men,—w much is it a piece? *Ans.* £2 : 1*s.*

18. In 19 moidores,—how many pounds sterling? *Ans.* £25 : 13*s.*

Of Troy Weight.

1. In 47 lb. 10 oz —how many grains? *Ans.* 275520 *gr.*

2. In 47128 grains of gold,—how many lb. *Ans* 8 *lb.* 2 *oz.* 3 *dwt.* 16 *gr.*

3. In 10 lb. of silver,—how many spoons, each 5 oz. dwts.? *Ans.* 21 *spoons, and* 90 *dwts. over.*

4. In 4560 grains of gold,—how many tea-spoons, each lf an ounce? *Ans.* 19 *tea-spoons.*

5. In 47 salvers, each 20 oz.—how many lb.? *Ans.* 78 *lb.* 4 *oz.*

6. How many porringers, each 11 oz. are in 19 lb 10 oz. dwts of silver? *Ans.* 21 *porringers, and* 151 *dwts. over.*

7. A goldsmith having 3 ingots of silver, each weighing oz. was minded to make them into spoons of 2 oz. cups 5 oz. salts of 1 oz. and snuff-boxes of 2 oz. and to have equal number of each; the question is, what was that mber? *Ans.* 8 *of each sort, and* 1 *oz. over.*

8. In 17 ingots of silver, each 27 oz. 10 dwts.—how ny grains? *Ans.* 224400 *gr.*

Of Avoirdupois Weight.

Q. Which are the allowances usually made in Avoirdu-s great Weight to the buyer?

A. They are Tare, Tret, and Cloff.

Q. What is Tare?

A. Tare is an allowance made to the buyer for the weight he box, bag, vessel, or whatever else contains the goods ight; and is either,

1. At so much per bag, barrel, box, &c.
2. At so much per cent. or,
3. At so much in the gross weight, called invoice tare.

Q. What is Tret?

A. Tret is an allowance made by the merchant to the buyer of 4lb in 104lb, that is, the six and twentieth part for the waste and dust, in some sorts of goods.

Note, If an allowance be made both for tare and tret, in the same parcel of goods, the tare is first to be deducted; and that remainder called suttle weight.

Q. What is Cloff?

A. Cloff is an allowance of 2lb. weight to the citizens of London, on every draught above 3 cwt. on some sorts of goods, as Galls, Madder, Sumac, Argol, &c.

Q. What are these allowances called beyond the seas?

A. They are called the Courtesies of London; because they are not practised in any other place.

Q. What is Gross Weight?

A. Gross is the weight of any sort of merchandize, and that which contains it, being weighed both together.

Q What is Neat Weight?

A. Neat is the pure weight of the goods, after all allowances are deducted.

Note 1. Raw, long, short, China Morea silk, &c. are weighed by great pound of 24 oz. But ferret, Filosella, sleeve silk, &c. by the common pound of 16 oz.

2. To bring great pounds into common, multiply by 3, and divide by
3. To bring common pounds into great, multiply by 2, and divide by

CASE I.

Examples.

1. In 7 cwt. 3 qrs. 10lb—how many oz. and drams? *Ans* 14048 *oz.* 224768
2. In 3 tons of iron,—how many cwt. qrs. and lb? *Ans.* 60 *cwt.* 240 *qrs.* 6720
3. In 14048 oz.—how many cwt? *Ans* 7 *cwt.* 3 *qrs.* 10
4. In 6720 lb. of iron, how many tons? *Ans.* 3
5. In 461 great pounds of Morea silk,—how many oz. and drams? *Ans.* 11064 *oz.* 177024
6. In 40426 drams of silk,—how many great pounds? *Ans* 105 *great pounds,* 6 *oz.* 10
7. In 3lb of cinnamon, how many parcels, each 12 oz? *Ans.* 4 *parcels*
8. In 470 parcels of sugar, each 26 lb—how many cwt? *Ans.* 109 *cwt.* 0 *qrs.* 12

9. In 672 great pounds of silk, how many common ounds? *Ans.* 1008 *common pounds.*

10. In 480 common pounds of silk, how many great ounds? *Ans* 320 *great lb.*

11. In 8 hogsheads of tobacco, each weighing neat $7\frac{1}{2}$ cwt. ow many pounds? *Ans.* 6720 *lb.*

12. In 17 pigs of lead, each weighing $4\frac{1}{4}$ cwt how many ther, at $19\frac{1}{2}$ cwt. *Ans.* 4 *fother,* 2 *cwt.* 3 *qrs.*

13. In 712 cwt of lead, how many fother? *Ans.* 36 *fother,* 10 *cwt.*

14. In 17 cwt. 1 qr. 6 lb. of sugar, how many parcels, ach 17 lb? *Ans.* 114 *parcels.*

Case II.

Of Tare and Tret, &c.

ote, If the teacher approve of it, he may introduce this and the following cases after practice, instead of this place

Q. When the tare is at so much per barrel, bag, &c. how the neat weight found?

A. Multiply the number of the said barrels, bags, &c. by e tare, and subtract the product from the gross, the remainder is the neat.

Note, 1. The table of allowance for tare, in the book of rates says;

For Cyprus and Smyrna silk.

Bales	about or above 300 lb	The tare per bale is	16
	from 300 to 200		14
	from 100 downwards		12

For Virginia tobacco.

Hhds.	5 cwt and upwards	The tare per hhd. is	100
	from 5 to 4 cwt		90
	from 4 to 3 cwt.		80
	under 3 cwt.		70

Sugar from India

In casks and cannisters,	Tare	1-6th
In chests and casks from St. Thome		5th

Oil from Canada

Tare 29 lb per barrel.

Note, 2, $7\frac{1}{2}$ lb. of oil make a gallon; therefore to reduce pounds into gallons, multiply by 2, and divide by 15,

Examples.

1. In 16 hogsheads of tobacco, each 5 cwt 1 qr. 19 lb. ross, tare per hogshead 100 lb —how much neat weight? *Ans.* 72 *cwt.* 1 *qr.* 20 *lb.*

					cwt.	qr.	lb.	
					5	1	19	
							4	by the parti
16					21	2	20	
100							4	
——4	cwt.	qr.	lb.					
28)1600(57(14		1	4	*gross*	86	2	24	
				tare	14	1	4	
				neat	72	1	20	

2. In 70 bales of Smyrna silk, each 317 lb. gross, ta per bale 16lb. - how many lb. neat? *Ans.* 21070 *lb ne*

3. In 14 hogsheads of tobacco, weighing gross, 89 cwt. qrs. 17 lb. tare perhogshead 100lb.—how much neat weigh *Ans.* 77 *cwt.* 1 *qr.* 17

4. What is the neat weight of 30 bales of Cyprus silk, eac weighing 249 lb. gross, tare per bale 14 lb? *Ans.* 7050 l

Case III.

Q. When the tare is at so much per cent. how is th neat weight found?

A. When the tare is an aliquot part or parts of the cw divide the whole gross by the said part or parts that th tare is of an cwt. and the quotient thence arising gives th tare of the whole; which subtract from the whole gros the remainder is neat.

Note 1 Figs, almonds, argol, &c - - - 14 lb. }
Caroteels, butts of currants, &c. 16 } per cent.
Oil in uncertain casks, &c. - - 18 }

2. Whatever part the given tare is of an cwt. the same must the who tare be of the given gross weight.

Examples.

1. What is the neat weight of 12 barrels of argol, gro 48 cwt. 3 qrs. 12 lb. tare 14 lb. per cent? *Ans.* 42 *cwt.* 3 *qr*

	C	qrs.	lb.	
$14=\frac{1}{8}$)	48	3	12	*gross.*
	6	0	12	*tare.*
	42	3	0	*neat.*

2. In 12 butts of currants, each 7 cwt. 1 qr, 10 lb. gro tare per cent. 16lb.—how much neat weight?

Ans. 75 *cwt.* 1 *qr.* 26 *lb.* 14

3. What is the neat Weight of 30 barrels of figs, each 2 wt. 3 qrs. grofs, tare per cent. 14 lb. ? *Anf. 72 cwt. 21lb,*

ote, When the tare is not the aliquot part or parts of an cwt. then multiply the pounds grofs by the tare per cent given, and that product divided by 112, the quotient is the whole tare, which fubtract from the grofs, the remainder is neat

4. What is the neat produce of 20 barrels of anchovies. ch grofs 33 lb. tare per cent. 10 lb ? *Anf 601lb 2 oz.*

5 What is the neat produce of 17 barrels of pot-afh, each ofs 203 lb. tare 19 lb. per cent. ? *Anf. 3142 lb. 14 oz.*

Case IV.

Q. When the tare is at fo much in the whole grofs ight, how is the neat weight found ?

Subtract the tare from the grofs, and the remainder is neat.

Examples.

. What is the neat weight of 38 hogfheads of tobacco, ghing grofs 201 cwt 3 qrs. 12 lb. tare in the whole o lb.? *Anf. 173 cwt. 3 qrs. 8 lb.*

. What is the neat weight of 3 hogfheads of tobacco, ghing as follows, *viz.*

	cwt.	*qrs.*	*lb.*		*lb.*
1.	3	1	2	Tare	80
2.	3	2	1		90
3.	5	1	12		100

Anf. 9 cwt. 3 qrs. 7 lb.

Case V.

. How is the neat weight found, when tret is allowed tare ?

. Divide the pounds futtle by 26, the quotient is the which fubtract from the futtle, the remainder is neat.

Examples

In 8 cwt 3 qrs. 20 lb. grofs, tare 38 lb. Tret 4 lb. per lb.—how many lb. neat.? *Anf 925 lb. neat.*

In 177 cwt. 0 qrs. 22 lb grofs, tare 9 lb. per cent. tret per 104 lb.—how many cwt. neat ?

Anf. 156 cwt. 2 qrs. 22 lb.

In 17 chefts of fugar, weighing 120 cwt. 2 qrs. grofs, 176 lb. tret 4 lb. per 104 lb.—how many cwt. neat ?

Anf. 114 cwt. 1 qr. 12 lb.

There are other allowances, not fo common, fuch as break, which t fo much per barrel, bag &c and damage, which is fo much he whole, but they are very eafy.

Of Apothecaries Weight.

In 12 ℔ 1 ℥ 2 ʒ 0 ℈ 1 gr.—how many grains ?

Anf. 69721 grains.

2. In 69721 grains, – how many ℈. ʒ. ℥. and ℔.
Ans. 12 ℔ 1 ℥. 2 ʒ. 0 ℈. 1

Of Long Measure.

1. In 70 miles,—how many furlongs and poles?
Ans. 560 *furlongs*, 22400 p

2. In 40 yards,—how many feet, inches, and barl corns? *Ans.* 120 *feet*, 1440 *inches*, 4320 *barley cor*

3. In 5 miles,—how many barley-corns?
Ans. 950400 *barley-cor*

4. In 4000 inches,—how many yds? *Ans.* 111 *yards*, 4

5. In 4 leagues,—how many yds? *An.* 21120 *Ya*

6. In 15840 yards,—how many miles and leagues?
An. 9 *miles*, 3 *leag*

7. How many barley-corns in a mile?
An. 190080 *barley co*

8. How many times doth the wheel which is 18 fe inches round, turn between London and York, which is miles? *An.* 42810 *Times*, *and* 180 *inches*

9 How many barley corns will reach round the glo the earth, which is 360 degrees, and each degree 69½ m
An. 4755801600 *barley c*

Of Cloth Measure.

1. In 14 yards, how many quarters and nails?
An 56 *qrs.* 224

2. In 17 yds. 1 qr. 2 na. how many nails? *An.* 27

3. In 4712 nails, how many yds? *An.* 294 *yds*,

4. In 47128 nails of Irish cloth,—how many pieces, 12 yards? *An.* 245 *pieces*, 5 *yards*,

5. In 4 pieces of cloth, each 14 yards,—how many q ters and nails? *An.* 224 *qrs.* 896

6. In 10 bales of cloth, each 10 pieces, each 12 yar how many yards? *An.* 120

7. In 7000 nails of Holland, how many ells? *An* 35

8. Reduce 42 ells into quarters and nails.
Facit 210 *qrs.* 840

Of Land Measure.

1. In 40 acres,—how many roods and perches?
An. 160 *roods*, 6400 p

2. In 17 a. 3 r. 10 p. how many perches? *An.* 28

3. Reduce 2850 perches into acres. *Facit* 17 *a*, 3

4. If a piece of ground contains 24 acres, and an inc of 17 acres 3 roods be taken out of it,—how many p are there in the remainder? *An.* 1000

5. One field contains 7 acres, another 10 acres, and a third 12 acres, 1 rood, how many shares of 76 perches each are contained in the whole? *Ans.* 61 *shares and* 44 *perches over.*

Of Liquid Measure.

1. In 17 gallons,—how many quarts and pints?
Ans. 68 *qts.* 136 *pints.*

2. In 10 barrels of beer,—how many gallons and quarts?
Ans. 360 *gallons,* 1440 *qts.*

3. In 4 barrels of ale, how many gallons; *Ans.* 128 *gal.*

4. In 72 hogsheads of beer,—how many barrels?
Ans. 108 *barrels.*

5. In 91 barrels of beer,—how many hogsheads?
Ans. 60 *hogsheads* 36 *gallons.*

6 If a back contains 30 barrels of beer,—how many gallons doth it hold? *Ans.* 1080 *gallons.*

7. In 4 tons of oil,—how many hogsheads, gallons, and quarts? *Ans* 16 *hogsheads,* 1008 *gallons,* 4032 *qts.*

8 In 3 hogsheads of brandy, how many half-anchors?
Ans. 37 *half-anchors,* 4 *gallons.*

9. In 1712 gallons of wine,—how many hogsheads?
Ans 27 *hogsheads,* 11 *gallons.*

10. If a vintner be desirous to draw off a pipe of Canary into bottles, containing pints, quarts, and two-quarts, and of each an equal number,—how many must he have?
Ans. 144 *of each sort.*

Of Dry Measure.

1. In 40 quarters of wheat, how many bushels and pecks?
Ans 320 *bushels,* 1280 *pecks.*

2. Reduce 1280 pecks of wheat into quarters, *Facit* 40 *qrs.*

3. In 30 chaldron of coals, each 36 bushels,—how many pecks? *Ans.* 4320 *pecks.*

4. Reduce 7094 pecks of coals into chaldrons.
Facit 49 *chaldrons,* 9 *bushels,* 2 *pecks.*

Of Time.

1. In 121812 seconds,—how many hours?
Ans. 33 *hours,* 50 *minutes,* 12 *seconds.*

2. Reduce 41 weeks into days, hours, and minutes.
Facit 287 *days,* 6888 *hours,* 413280 *minutes.*

3 Reduce 413280 minutes into weeks. *Facit* 41 *weeks.*

4. How many seconds in a year, allowing it to be 365 days, 6 hours? *Ans.* 31557600 *seconds.*

5. How many days have passed since the birth of Christ to Christmas, 1791? *Ans.* 654162 *days,* 18 *hours.*

6. From March 2 to November 19 following (inclusive) how many days? *Ans.* 263 *days.*

Of Motion.

In half a year's time the sun makes his progress through 6 signs of the Zodiac, how many degrees, minutes, and seconds doth that amount to?

Ans 180 *degrees*, 10800 *minutes*, 648000 *seconds*

Of the Single Rule of THREE.

Q. HOW many parts are there in the Rule of Three?

A. Two: Single or Simple, and Double or Compound.

Q. By what is the Single Rule of Three known?

A. By three terms, which are always given in the question to find a fourth.

Q. Are any of the terms given to be reduced from one denomination to another?

A. If any of the given terms be of several denominations they must be reduced into the lowest denomination mentioned.

Q. What do you observe concerning the first and third terms?

A. They must be of the same name and kind.

Q. What do you observe concerning the fourth term?

A. It is of the same name and kind with the second.

Q. What do you observe of the three given terms taken together?

A. That the two first are a supposition, and the last is a demand.

Q. How is the third term known?

A. It is known by these, or the like words, What cost? How many? How much?

Q. How many sorts of Proportion are there?

A. Two; Direct and Inverse.

1 Of Direct Proportion.

Q. What is Direct Proportion?

A. Direct Proportion is when more requires more, or less requires less.

Q. What do you mean by more requires more?

A More requires more, is when the third term is greater than the first; and therefore requires the fourth term to be greater than the second in the same proportion.

Q. What do you mean by less requires less?

A. Less requires less, is when the third term is less than the first; and therefore requires the fourth term to be less than the second in the like proportion.

Q. How is the fourth term in direct proportion found?
A. By multiplying the second and third terms together, and dividing that product by the first term.
Q What proportion does the fourth Number bear to any other?
A. It bears the same proportion to the second, as the third does to the first.
Q. How do you prove questions in the Rule of Three Direct?
A. By changing their order.

EXAMPLES.

1. If 3 oz. of silver cost 17s what will 48 oz. cost?

oz. s. oz. *Ans.* £13 ; 12*s.*
As 3 : 17 :: 48
17
— 2|0 *l.* *s.*
3)816(27|2(13 12

2. If 3 lb. of ginger cost 3s what cost 26lb? *Ans.* £1 : 6.
3. If 2 oz of silk cost 2s. 6d.—what cost 7lb? *Ans.* £ 7?
4. If one gallon of ale cost 8d—what cost 36 gallons? *Ans.* £1 : 4*s.*
5. If 1lb of sugar cost $4\frac{1}{2}$d. what cost 48 lb? *Ans.* 18*s.*
6. If 1lb. of sugar cost 4d. what cost 1 cwt? *Ans.* 1:17:4
7. If 1 cwt. of sugar cost 2l. 12s. what cost 1 lb. *Ans.* 5*d* $2\frac{32}{112}$ *qrs.*
8. If 1 gallon of beer cost 4d. what cost a barrel? *Ans.* 12*s.*
9. If one pair of stockings cost 2s. 3d. what cost 19 dozen pair? *Ans.* £. 25 : 13*s.*
10. If 19 dozen pair of shoes cost 25l. 13s what cost 1 pair? *An.* 2s. 3d.
11. Bought a firkin of butter, containing 56lb. for 18s 8d. what is that per lb? *An* 4*d.*
12. Sold 3 cwt. of tobacco, at 18d. per lb. what is the price of the whole? *An.* £25 : 4s.
13. Bought 19 chaldrons of coals, at 29s. 6d. per chaldron, what come they to? *An.* £28 : 0 : 6.
14. If 1lb. of sugar cost 9d. what cost 17 cwt 2 qrs? *An* £ 73 : 10.
15. If 1 oz of silver cost 5s 6d. what is the price of a tankard that weighs 1lb. 10 oz. 10 dwts. 4 grains? *An.* £6 : 3 : 9*d.* $2\frac{96}{480}$ *qrs.*
16. If 1 lb of tobacco cost 15d. what cost 3 hogsheads, weighing together 15 cwt 1 qr. 19 lb.? *An* £107 : 18 : 9
17. If a yard of cloth is worth 14s. what is the worth of pieces, each 19 yards? *Ans.* £ 66 : 10*s.*

18. If an ell of Holland cost 4s. 6d. what is the value of 5 pieces, each 12 ells? *Ans.* £ 13 : 10
19. If a bushel of coals cost 10d, how many chaldron for 100l? *Ans.* 66 *ch.* 24 *bush.*
20. How many quarters of corn for 40 guineas, at 4s *per* bushel? *Ans.* 26 *qrs.* 2 *bush.*
21. If a man's yearly income be 300l. what is it *per* day? *An.* 16. 5d 1 $\frac{15}{365}$ *qrs.*
22. If a man spends 7d *per* day, how much is that in a year? *An* £ 10 : 12 : 11
23. If a pint of wine cost 10d what cost 3 hogsheads? *An.* £ 63
24. If a pipe of Canary cost 40l. how much is that *per* pint? *An.* 9d. 2 $\frac{96}{100}$ *qrs.*
25 Bought 12 pieces of cloth, each 12 yards at 10s 6d *per* yard, what come they to? *An* £ 75 : 12
26 What cost 120 yards of cloth, at 3s *per* yard? *An* £ 18
27, A merchant bought 4 pieces of Holland, each 12 ells for 7 l. 10s.—what did 1 ell cost? *An* 3s : 1$\frac{1}{2}$
28. A grocer bought 3 hogsheads of sugar, each 10 cwt 3 qrs. 12 lb. gross, tare 26 lb. *per* hhd. at 2$\frac{1}{2}$d *per* lb. demand what the 3 hogsheads came to? *An* £ 37 : 3 :
29. How much must I pay for the carriage of 10$\frac{1}{2}$ cwt at the rate of 1$\frac{1}{2}$d. *per* lb? *An.* £ 7 : 7
30. If 6 horses eat up 21 bushels of oats in a week's time how many bushels will serve 20 horses the same time? *An* 70 *bu.*
31. If a family of 10 persons spend 3 bushels of malt a month, how many bushels will serve them when they are 30 in a family? *An.* 9 *bu.*
32. If an ingot of silver weighs 36 oz. 10 dwts. what is it worth at 5s. per oz? *An.* £ 9 : 2 :
33. How many yards of lace for 100l. at 3s. 6d. per yard. *An.* 571$\frac{18}{42}$ *yards*
34. If a merchant hath owing to him 1000l. and his debtor doth agree to pay him for every pound 12s. 6d. demand how much he must pay in all? *An.* £ 6
35. A goldsmith sold a tankard for 10l. 12s. at the rate of 5s. 4d. per oz. I demand the weight of it? *An* 39 *oz.* 15 *d*
36. A man bought a piece of cloth for 16l. 10s. at 1 per yard, how many yards did it contain? *An.* 22 *yards*
37. If 1 cwt. of cheese cost 37s 4d. what is that per lb? *A.*
38. Coals at 33s. per chaldron, how much per bushel? *An.* 1

39. What cost 49392 case knives, at 4s. 4d. *per* dozen?
Ans. £891 : 16s.

40. If a gentlemen has an estate of 245l. 10s. a year,—ow much may he spend one day with another, to lay up o guineas at the year's end? *Ans.* 10*s. per day.*

41. If 17 cwt. 3 qrs. 17 lb. of tobacco cost 133l. 13s. 4d. hat cost 1 oz? *Ans.* 1*d.*

42. If 1 cwt. of lead cost 15s, 11d.—what cost 5 fother
Ans. £77 : 11 : $10\frac{1}{2}$.

43. When the tun of wine cost 42l.—what cost 1 quart?
Ans. 10*d.*

44. At a noble *pe*[illegible], how many months board may have for 50l.? *Ans.* 37 *months*, 2 *weeks.*

45. What cost a peck of wool, weighing 2 cwt. 1 qr. 19lb. 8s. 6d *per* stone? *Ans.* £8 : 4 : 6*d.* $1\frac{10}{14}$ *qr.*

46. What is cheese *per* cwt. $3\frac{1}{2}$d *per* lb.? *Ans.* £1 : 12 : 8

47. If a yard of cambric cost 12s.—what cost 4 pieces ach 20 yards? *Ans.* £48

48 If a yard of broad cloth cost 18s.—what cost 5 pieces ach 20 yards? *Ans.* £90

49. If lead be sold for $1\frac{1}{2}$d. *per* lb.—what is 3 cwt. worth?
Ans £2 : 2

50. If coffee be sold for $8\frac{1}{4}$d. per oz.—what is 6 cwt. worth?
Ans. £369 : 12s.

2. *Of Inverse Proportion.*

Q. What is Inverse Proportion?

A. Inverse Proportion is when more requires less, or ss requires more.

Q. What is meant by more requires less?

A. More requires less, is when the third term is greater an the first, and requires the fourth term to be less than e second.

Q. What is meant by less requires more?

A. Less requires more, is when the third term is less than e first, and requires the fourth term to be greater than the cond.

Q. How is the fourth term in Inverse Proportion found?

A. By multiplying the first and second terms together, nd dividing that product by the third term.

What proportion does the fourth term bear to any of e rest?

A. It bears such proportion to the second, as the first oes to the third.

Examples.

1, If 48 men can build a wall in 24 days,—how many men can do the same in 192 days? *Ans.* 6 *men.*

2 If I lent my friend 100l for 6 months (allowing the month to be 30 days)—how long ought he to lend me 1000l. to requite my kindness? *Ans.* 18 *days.*

3 If 100l. in 12 months gain 6l. interest,—what principal will gain the same in 8 months? *Ans.* £ 150

4. If a footman performs a journey in 3 days, when the days are 16 hours long,—how many days will he require of 12 hours long to go the same journey in? *Ans.* 4 *days.*

5. How many yards of matting that is half a yard wide will cover a room that is 18 feet wide, and 30 feet long? *Ans* 120 *yards.*

6. If 28s will pay for the carriage of an cwt 130 miles,—how far may 6 cwt be carried for the same money? *Ans.* 25 *miles.*

7. How much in length, that is 3 inches broad will make a foot square? *Ans* 48 *inches.*

8. If 15 shillings worth of wine will serve 46 men, when the tun is worth 12l.—how many will the same 15 shillings worth suffice, when the tun is worth but 8l? *Ans.* 69 *men.*

9. If, when the price of a bushel of wheat is 6s 3d. the penny-loaf will weigh 9 oz.—what must the penny loaf weigh when wheat is at 4s. 6d. *per* bushel? *Ans.* 12 *oz.* 10 *dwts.*

10 Suppose 800 soldiers were placed in a garrison, and their provisions were computed sufficient for 2 months;—how many soldiers must depart that the provisions may serve them 5 months? *Ans.* 480 *men.*

11. There is a cistern having a cock, which will empty it in 12 hours; I demand how many cocks of the same capacity there must be to empty it in a quarter of an hour? *Ans.* 48 *cocks.*

12. There was a certain building raised in 8 months by 120 workmen, but the same being demolished it is required to be rebuilt in 2 months. I demand how many men must be employed about it? *Ans.* 480 Men.

13 A piece of tapestry is 3 ells Flemish wide, and 4 ells Flemish long, and it is required to be lined with something that is but 3 quarters of a yard wide;—I demand how many yards there must be to complete the lining? *Ans.* 9 *yards.*

Of PRACTICE.

Q. WHAT is Practice?

A. It is a short way of finding the value of ny quantity of goods, by the given price of one integer.

Q. How do you prove questions in Practice?

A. By the Single Rule of Three Direct: Or Practice nay be proved by itself, by varying the parts.

The Tables.

s.	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*Cwt.*	*lb.*
$\frac{1}{2}$ is	6	$\frac{1}{2}$ is	10	0	$\frac{1}{15}$	1	4	$\frac{1}{2}$ is	56
$\frac{1}{3}$	4	$\frac{1}{3}$	6	8	$\frac{1}{16}$	1	3	$\frac{1}{4}$	28
$\frac{1}{4}$	3	$\frac{1}{4}$	5	0	$\frac{1}{20}$	1	0	$\frac{1}{7}$	16
$\frac{1}{6}$	2	$\frac{1}{5}$	4	0	$\frac{1}{30}$	0	8	$\frac{1}{8}$	14
$\frac{1}{8}$	$1\frac{1}{2}$	$\frac{1}{6}$	3	4	$\frac{1}{40}$	0	6	$\frac{1}{14}$	8
$\frac{1}{12}$	1	$\frac{1}{8}$	2	6	$\frac{1}{60}$	0	4	$\frac{1}{16}$	7
		$\frac{1}{10}$	2	0	$\frac{1}{80}$	0	3		
		$\frac{1}{12}$	1	8	$\frac{1}{120}$	0	2		

Case I.

Q. What must be done with the price of an Integer, hen it is less than a penny?

A Find the aliquot parts of that price contained in a pen- , which must be divisors to the given sum; that is, if the ice be a farthing, say a farthing is the fourth of a penny, d set it thus, $\left|\frac{1}{4}\right|\frac{1}{4}\right|$. If the price be a halfpenny, then a halfpenny is the half, thus, $\left|\frac{1}{2}\right|\frac{1}{2}\right|$. If it is three far- ings, then say a halfpenny is the half of a penny, and a thing is the fourth of a penny, thus, $\left|\begin{array}{c|c}\frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{4}\end{array}\right|$

Q. What do you observe concerning these Columns?

A. The first column contains the money and the other parts.

te, 1 When there are more aliquot parts than one, their quotients must be added together, and the sum, if the first aliquot part be aken from a penny, will be pence: If it be taken from a shilling, ill be shillings; or if it be taken from a pound, will be pounds.

It is frequently better to take parts of parts than parts of the whole ice; and then the three farthings above-mentioned may as well be en thus, $\left|\begin{array}{c|c}\frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{2}\end{array}\right|$ that is, a halfpenny is the half of a penny, a farthing is the half of a halfpenny.

Examples.

$\frac{1}{4}$ | $\frac{1}{4}$	7612 at $\frac{1}{4}$	1280 at $\frac{1}{4}$
12	1903	
2|0	15|8 : 7	*Facit* £ 1 : 6 :
	£7 : 18 : 7	
$\frac{1}{2}$ | $\frac{1}{2}$	6812 at $\frac{1}{2}$	7672 at $\frac{1}{2}$
12	3406	
2|0	28|3 : 10	*Facit* £ 15 : 19 :
	£ 14 : 3 : 10	
$\frac{1}{2}$ | $\frac{1}{2}$	4712 at $\frac{3}{4}$	9180 at $\frac{3}{4}$
$\frac{1}{4}$ | $\frac{1}{4}$	2356	
	1178	
12	3534	*Facit* £28 : 13 :
2|0	29|4 : 6	
	£ 14 : 14 : 6	

Case II.

Q. What must be done with the price of an Integ[er] when it is less than a shilling?

A. Find the aliquot parts of that price contained i[n a] shilling, which must be divisors to the given sum. Or th[us:] If the given price be not the aliquot part of a shilling, [then] first take some part of it that is an aliquot part, and for [the] remaining part of the price, let it be taken out of the f[ore-]going part or parts, and then add the quotients togethe[r as] before; the total will be the answer in shillings.

Examples.

1 | $\frac{1}{12}$	7612 at 1d.	6812 at 1d.
2|0	63|4 : 4	*Facit* £ 28 :
	£ 31 : 14 : 4	
1 | $\frac{1}{12}$	8612 at $1\frac{1}{4}$d.	1861 at $1\frac{1}{4}$d.
$\frac{1}{4}$ | $\frac{1}{4}$	717 : 8	*Facit* £ 9 : 13 :
	179 : 5	
2|0	89|7 : 1	4121 : 1 : $1\frac{1}{4}$
	£ 44 : 17 : 1	*Facit* £25 :

1861 at $1\frac{3}{4}$d.

Facit £13 : 11 : $4\frac{3}{4}$

4761 at 2d.

Facit £39 : 13 : 6

6181 at $2\frac{1}{4}$d.

Facit £57 : 18 : $11\frac{1}{4}$

1218 at $2\frac{1}{2}$d.

Facit £12 : 13 : 9

8012 at $2\frac{3}{4}$d.

Facit £91 : 16 : 1

7612 at 3d.

Facit £95 : 3

6128 at $3\frac{1}{4}$d.

Facit £82 : 19 : 8

6180 at $3\frac{1}{2}$d.

Facit £90 : 2 : 6

7812 at $3\frac{3}{4}$d.

Facit £122 : 1 : 3

8120 at 4d.

Facit £135 : 6 : 8

7000 at $4\frac{1}{4}$d.

Facit £123 : 19 : 2

6001 at $4\frac{1}{2}$d.

Facit £112 : 10 : $4\frac{1}{2}$

7121 at $4\frac{3}{4}$d.

Facit £140 : 18 : $8\frac{3}{4}$

7181 at 5d.

Facit £149 : 12 : 1

8121 at $5\frac{1}{4}$d.

Facit £177 : 12 : $11\frac{1}{4}$

6128 at $5\frac{1}{2}$d.

Facit £140 : 8 : 8

6100 at $5\frac{3}{4}$d.

Facit £146 : 2 : 11

1000 at 6d.

Facit £25

7610 at $6\frac{1}{4}$d.

Facit £198 : 3 : $6\frac{1}{2}$

1218 at $6\frac{1}{2}$d.

Facit £32 : 19 : 9

6000 at $6\frac{3}{4}$d.

Facit £168 : 15

7101 at 7d.

Facit £207 : 2 : 3

1001 at $7\frac{1}{4}$d.

Facit £30 : 4 : $9\frac{1}{4}$

4100 at $7\frac{1}{2}$d.

Facit £128 : 2 : 6

6120 at $7\frac{3}{4}$d.

Facit £197 : 12 : 6

7100 at 8d.

Facit £236 : 13 : 4

6100 at $8\frac{1}{4}$d.

Facit £209 : 13 : 9

8000 at $8\frac{1}{2}$d.

Facit £283 : 6 : 8

6000 at $8\frac{3}{4}$d.

Facit £218 : 15

9000 at 9d.

Facit £337 : 10

4121 at $9\frac{1}{4}$d.

Facit £158 : 16 : $7\frac{1}{4}$

6100 at $9\frac{1}{2}$d.

Facit £241 : 9 : 2

5918 at $9\frac{3}{4}$d.

Facit £240 : 8 : $4\frac{1}{2}$

8121 at 10d. †

Facit £338 : 7 : 6

6712 at $10\frac{1}{4}$d.

Facit £286 : 13 : 2

1002 at $10\frac{1}{2}$d.

Facit £43 : 16 : 9

4680 at $10\frac{3}{4}$d.

Facit £209 : 12 : 6

1260 at 11d.

Facit £57 : 15

6121 at $11\frac{1}{4}$d.

Facit £286 : 18 : $5\frac{1}{4}$

1234 at $11\frac{1}{2}$d.

Facit £59 : 2 : 7

2345 at $11\frac{3}{4}$d.

Facit £114 : 16 : $1\frac{3}{4}$

100 at $11\frac{3}{4}$d.

Facit £4 : 17 : 11

† *Note*, When the price of an integer is 10d. annex a cypher to the given number, and divide by 12 and by 20.

Case III.

Q. What must be done with the price of an Integer, when is greater than a shilling, but less than two shillings?

A. Let the part or parts be taken only with so much of he given price as is more than one shilling; that is, if the rice be 14½d. take the parts only with 2½d. and let the iven quantity stand for shillings which must be added with he rest; and the total will be the answer in shillings.

Examples.

¼	486 at 12¼d.
12	121 ½
	10 : 1 ½
2|0	49|6 : 1 ½
	£24 : 16 : 1½

½	486 at 12½d.
12	243
	20 : 3
2|0	50|6 : 3
	£25 : 6 : 3

7612 at 12¼d.

Facit £388 : 10 : 7

1216 at 12½d.

Facit £63 : 6 : 8

1216 at 12¾d.

Facit £64 : 12

6121 at 13d.

Facit £331 : 11 : 1

1281 at 13¼d.

Facit £70 : 14 : 5¼

6100 at 13½d.

Facit £343 : 2 : 6

1210 at 13¾d.

Facit £69 : 6 : 5½

1210 at 14d.

Facit £70 : 11 : 8

1271 at 14¼d.

Facit £75 : 9 : 3¾

6120 at 14½d.

Facit £369 : 15

1210 at 14¾d.

Facit £74 : 7 : 3½

1260 at 15d.

Facit £78 : 15

1612 at $15\frac{1}{4}$d.

Facit L102 : 8 : 7

1210 at $15\frac{1}{2}$d.

Facit L78 : 2 : 11

7612 at $15\frac{3}{4}$d.

Facit L499 : 10 : 9

6100 at 16d.

Facit L406 : 13 : 4

7121 at $16\frac{1}{4}$d.

Facit L482 . 3 : $0\frac{3}{4}$

1218 at $16\frac{1}{2}$d.

Facit £83 : 14 : 9

8100 at $16\frac{3}{4}$d.

Facit L565 : 6 : 3

4128 at 17d.

Facit L292 : 8

1230 at $17\frac{1}{4}$d.

Facit L88 : 8 : $1\frac{1}{2}$

2340 at $17\frac{1}{2}$d.

Facit L170 : 12 : 6

3450 at $17\frac{3}{4}$d.

Facit L255 : 3 : $1\frac{1}{2}$

4560 at 18d.

Facit L342

5670 at $18\frac{1}{4}$d.

Facit L431 : 3 : $1\frac{1}{2}$

6789 at $18\frac{1}{2}$d.

Facit L523 : 6 : $4\frac{1}{2}$

7890 at $18\frac{3}{4}$d.

Facit L616 : 8 : $1\frac{1}{2}$

8900 at 19d.

Facit L704 : 11 : 8

9000 at $19\frac{1}{4}$d.

Facit L721 : 17 : 6

9876 at $19\frac{1}{2}$d.

Facit £802 : 8 : 6

8765 at $19\frac{3}{4}$d.

Facit L721 : 5 : $8\frac{3}{4}$

7120 at $20\frac{1}{4}$d.

Facit L600 : 15

6543 at $20\frac{1}{2}$d.

Facit L558 : 17 :

5432 at $20\frac{3}{4}$d.

Facit L469 : 12 : 1

4321 at 21d.

Facit £378 : 1 : 9

3210 at $21\frac{1}{4}$d.

Facit £284 : 4 : $4\frac{1}{2}$

2100 at $21\frac{1}{2}$d.

Facit £188 : 2 : 6

1000 at $21\frac{3}{4}$d.

Facit £90 : 12 : 6

1090 at 22d †

Facit £99 : 18 : 4

9010 at $22\frac{1}{4}$d.

Facit £835 : 6 : $0\frac{1}{2}$

6700 at $22\frac{1}{2}$d.

Facit £628 : 2 : 6

6812 at $22\frac{3}{4}$d.

Facit £645 : 14 : 5

1210 at 23d.

Facit £115 : 19 : 2

1800 at $23\frac{1}{4}$d.

Facit £174 : 7 : 6

6760 at $23\frac{1}{2}$d.

Facit £661 : 18 : 4

9990 at $23\frac{3}{4}$d.

Facit £988 : 11 : $10\frac{1}{2}$

† Note, When the price of an integer is 22d. annex a Cypher to the given number, and divide by 12 (as at 10d.) then add both lines together, the sum will be the total in shillings.

Case IV.

Q. What must be done with the price of an Integer, when it is any even number of shillings under 20s, as 6s. 8s. &c.

A. Multiply the given quantity by half of the price, and double the first figure of the product of shillings, and the rest of the product will be pounds.

Note. This rule is taken from an operation in Decimals.

Examples.

486 at 2s.
1

£48 : 12s.

769 at 4s.
2

£153 : 16s.

7612 at 2s.

Facit £761 : 4s.

1286 at 4s.

Facit £257 : 4s.

7618 at 6s.	171 at 14s.
Facit £2285 : 8s.	*Facit* £119 : 14
191 at 8s.	171 at 16s.
Facit £76 : 8s.	*Facit* £136 : 16
180 at 10s. *	712 at 18s.
Facit £90	*Facit* £640 : 16

* Note, When the price of an Integer is 10s. you may take half the given Integers, and it is done ; and the remainder (if there be any) will be 10s.

Case V.

Q. What must be done with the price of an Integer, when it is any odd number of shillings under 20 as 3s 5s, &c.

A. Multiply the given Integers by the prices, and the product divide by 20, the quotient will be the answer.

Examples.

121 at 1s.	121 at 11s.
Facit £6 : 1s	*Facit* £66 : 1
121 at 3s.	600 at 13s.
Facit £18 : 3s	*Facit* £39
471 at 5s. †	190 at 15s.
Facit £117 : 15s	*Facit* £142 : 1
860 at 7s.	121 at 17s.
Facit £301	*Facit* £102 : 1
612 at 9s.	100 at 19s.
Facit £275 : 8s	*Facit* £9

† Note, When the price of an Integer is 5s. the work may be done at once, because 5s. is the fourth part of a pound.

Case VI.

Q. What must be done with the price of an Integer, hen it is shillings and pence ?

A. 1 If the shillings and pence be the aliquot part of a ound, it may be done at once, as 6s 8d is the third of a und.

Examples.

12 at 6s. 8d.

Facit £4

69 at 3s. 4d.

Facit £11 : 10

21 at 2s. 6d.

Facit £2 : 12 : 6

96 at 1s. 8d.

Facit £8

2. If the shillings and pence be not the aliquot part of a ound, or if there be shillings, pence and farthings, multi-y the given quantity by the shillings, and take parts with e rest, and add them together ; the sum will be the an-er in shillings.

Examples.

3 | $\frac{1}{4}$	126 at 9s. 3d.
	9
	1134
	31 : 6
2|0	116|5 : 6
	£58 : 5 : 6

86 at 6s. 10d.

Facit £29 : 7 : 8

10 at 12s. 4d.

Facit £6 : 3 : 4

30 at 4s. 9d.

Facit £7 : 2 : 6

73 at 7s. 6d.

Facit £27 : 7 : 6

70 at 7s. $4\frac{3}{4}$d.

Facit £25 : 17 : $8\frac{1}{2}$

55 at 4s. $8\frac{1}{2}$d.

Facit £12 : 18 : $11\frac{1}{2}$

77 at 10s. $6\frac{1}{4}$d.

Facit £40 : 10 : $1\frac{1}{4}$

12 at 13s. $10\frac{1}{2}$d.

Facit £8 : 6 : 6

17 at 17s. $4\frac{1}{4}$d.

Facit £14 : 15 : $0\frac{1}{4}$

46 at 7s. $3\frac{1}{4}$d.

Facit £16 : 16 : $4\frac{1}{2}$

CASE VII.

Q. What must be done with the price of an Integ[er] when it is pounds only?

A. Multiply the given Integers by the price, the prod[uct] will be the answer

Examples.

72 at 5l.

Facit £360

64 at 3l.

Facit £192

19 at 4l.

Facit L

46 at 7l.

Facit L

CASE VIII.

Q. What must be done with the price of an Integ[er] when it is pounds and shillings?

A. Multiply the integers given, by the pounds; th[en] proceed with the shillings if they are even, according [to] Case IV. but if they are odd, according to Case V. and a[dd] them together: the total will be the answer.

Examples.

26 at 4l. 8s.
4
104
10 : 8
£114 : 8

49 at 3l. 7s.
7
343
2|c 17 : 3
147
£164 : 3

36 at 5l. 13s.

Facit £203 : 8s

48 at 7l. 10s.

Facit L36

26 at 11l. 14s.

Facit L304 :

15 at 4l. 13s.

Facit L69 : 1

17 at 9l. 15s.

Facit L165 : 15

16 at 3l. 6s

Facit L52 : 16

Case IX.

Q. What must be done with the price of an integer, when it is pounds, shillings and pence?

A. 1. If the shillings and pence be the aliquot part of a pound, multiply the given integers by the pounds, and divide by the aliquot part; Those numbers so found out, being added together, will be the sum required.

Examples.

47 at 3l. 3s. 4d.

Facit L148 : 16 : 8

20 at 4l. 13s. 4d.

Facit L93 : 6 : 8

17 at 2l. 6s. 8d.

Facit L39 : 13 : 4

30 at 1l. 2s. 6d.

Facit L33 : 15s

2. If the shillings and pence be not the aliquot part of a pound, or if there be shillings, pence, and farthings, given with the pounds, then reduce the pounds and shillings, into shillings, and multiply the given integers by the said shillings; next take parts with the rest of the price, and add them together as before.

Examples.

3	$\frac{1}{4}$	120 at 4l. 7s. $3\frac{1}{2}$d.
		87 20
		10440 87
$\frac{1}{2}$	$\frac{1}{6}$	30
		5
	2|0	1047|5
		£523 : 15s.

14 at 2l. 10s. 6d.

Facit L35 : 7s.

21 at 5l. 14s. $7\frac{1}{4}$d.

Facit L120 : 6 : $8\frac{1}{4}$

70 at 1l. 14s. 7d.

Facit L121 : 0 : 10

46 at 3l. 19s. $8\frac{1}{2}$d.

Facit L183 : 6 : 7

Q. What other way have you of answering questions in this case?

A. 1. When the number of integers does not exceed 12, multiply the price by the Integers, as in Compound Multiplication, the product will be the answer.

2 When the number of integers does exceed 12, multiply the price by the parts instead of the whole. Or,

3. You may multiply the price by the whole number of integers. Thus,

58361 hhds. of tobacco, at 48l. 12s. 9d. per hhd.

l.	s.	d.
48	12	9
	58361	
48	12	9
2918	5	0
14591	5	0
389100	0	0
2431875	0	0
2838533	2	9

Memorandum.

1.		2.		3.		4.	
s.	d.	s.	d.	s.	d.	s.	d.
16	6						
18	3	2	6				
2	0						
3	9	17	6	15	0	10	0

Q. How is it wrought?

A. Multiply by the several figures in the multiplier as in Compound Multiplication, but with this difference, that the product of the shillings and pence, Multiplied by the 6, 3, 8, and 5, must be placed by themselves in a Memorandum, and the product of the pounds by the same figures, placed as in Simple Multiplication. Thus,

	l.	s.	d.	Memor. s.	d.
	48	12	9		
		58361			
1 Product	48 :	12 :	9	16	6
2	291			18	3
3	145			2	0
4	389			3	9
5	243				

Then to fill up the blanks in the second product, take half of the 16s in the memorandum, which is 8, and set it in the unit's place of the pounds. Annex a cypher to the 6d which makes 60d. or the 5s place this under the shillings, and the line is done with, there being no price remaining.

For the blanks in the third product, take half of the 18s in the memorandum, and put it in the ten's place of the pounds. Annex a cypher to the 3d, which makes it 30d or 2s. 6d. this put in the second memorandum. Then take half of the 2s. in this new memorandum, and put it in the unit's place of the pounds. Annex a cypher to the 6d in the new memorandum, which makes 60d. or 5s. put this in the place of shillings, and the line is finished, there being no pence remaining.

For the blanks in the fourth product, take half of the 2s. in the first memorandum, and put it into the hundred's place of the pounds: and because there remains nothing, nor are there any pence in the memorandum, therefore fill up the other blanks with cyphers and the line is finished.

For the blanks in the fifth product, take half of the 3s. in the first memorandum, and put it in the thousand's place of the pounds; then because there is one remaining, put that in the second memorandum. Annex a cypher to the 9d. which makes 90d. or 7s. 6d. put this to the former 1, and it makes 17s. 6d. take half the 17s and put in the hundred's place of the pounds; then, because there is one remaining, put that in the third memorandum. Annex a cypher to the 6d. and it makes 60d. or 5s. put this to the 1 in the third memorandum, and it makes 15s. take half of the 15s, and put it in the tens place of the pounds; then because there remains 1, put it in the fourth memorandum, and since there are no pence in the third memorandum, to put a cypher to, let a cypher be annexed to the 1 in the last memorandum, which makes 10s. take half of this 10s. and put it in the unit's place of the pounds; then, because there are no pence in the memorandum, neither is there any thing remaining of the 10, therefore fill up the other blanks with cyphers, and the line is completed; Add all together, and their sum is the total product of the whole.

	l.	s.	d.		Memorandum		
					1.	2.	3.
7000 hhds. of wine at	17	14	8 per hhd.		s. d	s. d.	s. d.
			7000				
	124133	6	8		2 8	6 8	6 8

Note, 1. To fill up the blanks in the pounds of the second, third, &c. products, always take half of the shillings in the memorandum; and if 1 remains make a new memorandum of it.

2. Always annex a cypher to the pence, and whatever number of shillings they make, put them to the 1 in the new memorandum; and so on till all the blanks in the pounds are filled up: If there be any pence yet remaining in the memorandum, put a cypher to them, and what shillings and pence they make, let them be put in the shillings and pence' place in the product.

3. All the examples in this case, and case 8, may serve here, instead of others.

Case X.

Q. What must be done with the price of an integer, when both that and the quantity given are of several denominations?

A. Multiply the price by the integers, and take parts with the parts of integers.

Examples.

C.	qrs.	lb.		l.	s.			l.	s.	d.
12	3	16	of tobacco, at	4	12	per cwt.	*Facit*	59	6	1$\frac{1}{2}$+

$\frac{1}{2}$	$\frac{1}{2}$		12	
		55	4	
$\frac{1}{4}$	$\frac{1}{2}$	2	6	
16	$\frac{1}{7}$	1	3	
		0	13	1$\frac{1}{2}$+
		£59	6	1$\frac{1}{2}$+

C.	qrs.	lb.		l.	s.	d.			l.	s.	d.
12	2	14	of tobacco, at	3	14	0	*per* cwt.	F*acit*	46	14	3
17	3	19	of ſugar, at	2	2	6	*per* cwt	F*acit*	80	1	6$\frac{1}{4}$
4	1	16	of ſoap, at	3	12	0	*per* cwt	F*acit*	15	16	3$\frac{1}{2}$
10	0	12	of tallow, at	1	19	6	*per* cwt.	F*acit*	19	19	2$\frac{1}{4}$
5	1	0	of tobacco, at	2	17	0	*per* cwt.	F*acit*	14	19	3
4	3	0	of ſugar, at	2	18	6	*per* cwt	F*acit*	13	17	10$\frac{1}{2}$
7	0	19	of ſugar, at	3	16	0	*per* cwt	F*acit*	27	4	10$\frac{1}{4}$
5	2	10	of tobacco, at	2	18	6$\frac{1}{2}$	*per* cwt	F*acit*	16	17	2$\frac{1}{4}$
7	1	14	of tobacco, at	3	15	9$\frac{1}{4}$	*per* cwt	F*acit*	27	18	9$\frac{1}{4}$
9	2	26	of tallow, at	4	10	4$\frac{1}{2}$	*per* cwt	F*acit*	43	19	6

OF INTEREST.

Q. HOW many kinds of Intereſt are there?

A. Two: Simple and Compound.

Of Simple Intereſt.

Q. What is Simple Intereſt?

A. Simple Intereſt is the profit allowed in the lending or forbearance of any ſum of money for ſome determined ſpace of time.

Q. What is the principal?

A. The principal is any ſum of money lent, for which intereſt is to be received.

Q. What is the rate *per cent*?

A. It is a certain ſum agreed on between the lender and the borrower, to be paid for every 100 pounds for the uſe of the principal, which, according to the laws of England, ought not to be above 5l. for the uſe of 100l. for one year, and 10l. for the uſe of 100l. for two years; and ſo on for any ſum of money, in proportion to the time propoſed.

Q. What is the amount?

A. It is the principal and intereſt added together.

Q. What other things are intereſt applicable to?

A. It is applied to commiſſion or proviſion, brokage, orage, and inſurance, which have no reſpect to time.

Caſe I.

Q. How do you find the intereſt of any given ſum for a ear?

A. Multiply the principal by the rate *per cent.* and divide hat product by 100, the quotient is the intereſt required.

Q. How do you find the intereſt of any given ſum for everal years?

A. Multiply the intereſt for one year by the number of ears given in the queſtion; the product will be the anſwer.

Examples.

1. If 100l. in one year's time yield 5l. intereſt—what will 486l. yield in the ſame time? *Anſ* £ 24 : 6.

£486
5
———
24|30
|20
|—
6|00

2, What is the intereſt of 220l. for a year at 4 *per cent. per. ann?* *Anſ* £ 8 : 16.

3 What is the intereſt of 76l. for two years, at 5 *per cent. per ann?* *Anſ.* £7 : 12.

4. What is the amount of 400l. for 12 years, at 6 *per cent per ann?* *Anſ.* £688

Of factors' Allowances, commonly called Commiſſion or Proviſion.

Q. What is commiſſion or Proviſion?

A. It is an allowance from merchants to their factors or agents beyond the ſeas, in the buying or ſelling of any ſort of goods; and it is a certain rate *per cent* according to the cuſtom of the country where the factor reſides.

Examples.

5. My factor ſends me word, that he has bought goods to the value of 500l. 13s. 6d. upon my account; I demand what his commiſſion comes to, at $3\frac{1}{2}$ *per cent.*

Anſ. £ 17 : 10 : 5 : $2\frac{68}{100}$ *qrs.*

6. My correſpondent has diſburſed upon my account, the ſum of 1009l. 18s what muſt he demand for his commiſſion, when I allow him $2\frac{1}{4}$ *per cent* ?

Anſ. £ 22 : 14 : 5 : $1\frac{84}{100}$ *qr.*

7 Suppoſe I allow my correſpondent $1\frac{3}{4}$ *per cent.* for proviſion; what may he demand on the diſburſement of 704l. 15s 4d ? *Anſ.* £ 12 : 6 : $8\frac{1}{100}$ *d.*

Caſe II.

Q. How do you find the intereſt of any ſum for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, of a year, beſides the number of years given in the queſtion ?

A. For $\frac{1}{4}$ of a year, take a fourth part of the intereſt for one year; for $\frac{1}{2}$ a year take half of the intereſt for one year; for $\frac{3}{4}$ of a year, take the parts compounded of $\frac{3}{4}$ and add them to the intereſt for the reſt of the time; the ſum will be the intereſt required.

Examples.

1. What is the intereſt of 200l. for 3 years and $\frac{3}{4}$ at 5 *per cent. per ann.* ? *Anſ.* £37 . 10s.

200	$\frac{1}{2}$	$\frac{1}{2}$	10	
5			3	
10|00			30	
	$\frac{1}{4}$	$\frac{1}{2}$	5	
			2	10
			£37	10s

2. What is the intereſt of 468l, 12s 4d. for $1\frac{3}{4}$, year, at 6 *per cent. per ann.*? *Anſ.* £49 : 4 : 1.

3. What is the intereſt of 112l. 10s. 4d for $5\frac{1}{2}$ years at 6 *per cent per ann* ? *Anſ.* £ 37 : 2 : 6*d*+

4 What is the intereſt of 468l. for $4\frac{1}{4}$ years, at 6 *per cent per ann* ? *Anſ.* £119 : 6 : $8\frac{1}{4}$.

5. What is the intereſt of 1000l. for $2\frac{3}{4}$ years, at 4 *per cent per ann.* ? *Anſ.* £110.

Of Brokage.

Q. What is brokage ?

A It is an allowance made to perſons called brokers, at a certain rate *per cent.* for finding cuſtomers, and ſelling to them the goods of other men, whether ſtrangers or natives.

Q. How do you find the brokage of any ſum ?

A. Divide the given ſum by 100, and take parts from the quotient with the rate *per cent.*

Examples.

6. What is the brokage of 700l. 14s. 6d. at 4s. *per cent.*?

Ans. £ 1 : 8 : 0$\frac{1}{4}$,

l.	s.	d.			l.	s.	d.
7|00	14	6	4	$\frac{1}{5}$	7	0	1$\frac{1}{2}$
|20					1	8	0$\frac{1}{4}$
0|14							
|12							
1|74							
|4							
2|96							

7. What may a broker demand for brokage, when he sells oods to the value of 500l 10s 7d and I allow him 7s. *per nt*? *Ans.* £ 1 : 15 : 0$\frac{1}{4}$.

8 Suppose I employ a broker, who sells goods to the value of 909l. 14s. 10d what is the brokage at 6s 6d *per nt.*? *Ans.* £ 2 : 19 : 1$\frac{1}{4}$.

Note, If the brokage should be 1l or more *per cent.* the operation will be the same with that in Factor's Allowances.

Case III.

Q. How is the interest of any sum found when the rate *er cent,* is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ more than the pounds given in the id rate?

A. Multiply the principal by the pounds in the rate *per nt,* as before; and let the parts for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, be taken om the principal, and added to that product, then proceed according to case 1 or 2.

Examples.

1. What is the interest of 400l. for 2 years, at 5 $\frac{1}{2}$ *per cent. r ann*? *Ans,* £ 44.

2. What is the interest of 120l. for a year, at 4$\frac{1}{2}$ *per cent. r ann*? *Ans* £ 5 : 8*s*.

3. What is the amount of 690l. for 3 years, at 4$\frac{1}{4}$ *per nt per ann*? *Ans.* £ 777 : 19 : 6.

4. What is the amount of 120l. 10s for 2 years and an alf, at 4$\frac{3}{4}$ *per cent per ann*? *Ans,* £ 134 : 16 : 1$\frac{3}{4}$.

5. What is the interest of 300l. for 5 years and 3 quarters at 3$\frac{3}{4}$ *per cent. per ann*? *Ans* £ 64 : 13 : 9.

Case IV.

Q. How do you find the interest of any sum for a certain number of weeks?

A. As 52 weeks
Are to the interest of the given sum for a year:
So are the weeks given,
To the interest required.

Examples.

1. What is the interest of 400l. for a week, at 5 *per cent per ann*? *Ans* 7s. 8d. $1\frac{12}{52}$ q.

2. What is the interest of 126l. 12s. for 16 weeks, at 4 *per cent per ann*? *Ans.* £1 : 15 : 0 : $2\frac{40}{52}$ qr.

3. What is the amount of 500l. for 20 weeks at $3\frac{1}{2}$ per *cent per ann.*? *Ans.* £506 : 14 : 7 : $1\frac{28}{52}$ q.

Case V.

Q. How is the principal found, when the amount, time and rate per cent are given?

A. As the amount of 100l. at the rate and time given
Is to 100l.
So is the amount given,
To the principal required.

Examples.

1. What principal being put to interest for 9 years at 5 *per cent per ann.* will amount to 725l? *Ans.* £ 500

2. What principal being put to interest for 7 years, will amount to 793l 12s. at 4 *per cent per ann*? *Ans.* £ 620

3. What sum being put to interest, will amount to 520l 16s. in 8 years, at 3 *per cent. per ann.* *Ans.* £420

Case VI.

Q. How is the rate *per cent* found, when the amount, time and principal are given?

A. 1 As the principal,
Is to the interest for the whole time:
So is 100l.
To its interest for the same time.

2. Divide the interest last found by the time, and the quotient will be the rate *per cent.*

Examples.

1. At what rate of interest *per cent.* will 500l. amount to 725l. in 9 years time? *Ans.* £ 5 *per cent.*

2. At what rate of interest *per cent.* will 620l. amount to 793l. 12s. in 7 years? *Ans.* 4 *per cent.*

3. At what rate of interest *per cent.* will 420l. amount to 520l. 16s. in 8 years? *Ans.* 3 *per cent.*

Case VII.

Q. How is the time found, when the principal amount, and rate *per cent.* are given?

A. As the interest of the principal for 1 year at the given rate
Is to one year:
So is the whole interest,
To the time required.

Examples.

1. In what time will 500l. amount to 725*l*, at 5 *per cent. per ann*? *Ans* 9 *years*.
2. In what time will 620l. amount to 793l. 12s. at 4 *per cent per ann*? *Ans.* 7 *years*.
3. In what time will 420l. amount to 520l. 16s. at 3 *per cent per ann*? *Ans* 8 *years*.

Q. How are the questions in the foregoing cases proved?

A. Cases 1, 5, 6, and 7, do exactly prove each other, by varying the questions: Yet all of them, except Case V. and the 1st, 2d. 5th, 6th, and 7th questions in Case I.; and the 6th, 7th and 8th, in Case II. may as truly be answered by the Double Rule of Three, of which more hereafter.

Note 1, The 1st, 2d, 5th, 6th, and 7th questions in Case I and the 6th 7th, and 8th in Case II are to be proved by the Single Rule of Three. 2. Case V cannot be answered by the Double Rule of Three, because the principal is not known in the question, and therefore there can be no deduction of it from the amount, to know the interest, which must first be done.

Of Simple Interest for Days.

Q. How do you find the interest for any number of days?

A. Multiply the pence of the principal by the days, and by the rate of interest for a dividend, and 365 by 100 for a divisor, the quotient will be the answer in pence.

Q. How are the following questions proved?

A. As 365 days
Are to the interest of the given sum for a year:
So is the time proposed,
To the interest required.

Examples.

1. What is the interest of 120l. for 126 days, at 4 *per cent. per ann*? *Ans.* £ 1 : 13 : 1 : $2\frac{258}{365}$ *qrs.*
2. What is the interest of 126l. for 145 days, at 6 *per cent. per ann*? *Ans.* £ 3 : 0 : $3\frac{57}{365}$ *qrs.*

3. What is the interest of 100l. from June 1, 1783, to March 9, 1784, which is leap year, at 5 *per cent. per ann.*
Ans. £3 : 17 : 6 : $1\frac{235}{365}$

4. What is the interest of 200l. from August 14, to December 19 following, at 6 *per cent. per ann*?
Ans. £4 : 4 : 1 : $3\frac{325}{365}$

5. What is the interest of 10l. for 25 days, at 5 *per cent. per ann*? *Ans.* $8\frac{30}{365}$

6. What is the interest of 40l. for 40 days, at 4 *per cent. per ann.*? *Ans.* 3s. $6\frac{30}{365}$

Note, See more of Simple Interest in Decimals.

Of Compound Interest.

Q. What is Compound Interest?

A. Compound Interest is that which arises from a principal and its interest put together as the interest still becomes due; and for that reason it is called interest upon interest, or compound interest.

Q. Is it lawful to let out money at compound interest?

A. No; Yet in purchasing annuities or pensions, and leases in reversion, it is very usual to allow compound interest to the purchaser for his ready money; and therefore it is very necessary for him to understand it.

Q. How do you find the compound interest of any given sum for any number of years?

A. 1. Find the amount of the given sum by simple interest for the first year, which is the principal for the second year, then find the amount of that principal for the second year, and that is the principal for the third year: and so on for any number of years given.

2. Subtract the given sum from the last amount, and the remainder is the compound interest required.

Examples

1. What sum will 450l. amount to in 3 years, at 5 *per cent. per ann.* compound interest? *Ans.* £520 : 18 : $7\frac{1}{2}$d.

2. What will 400l. amount to in 4 years, at 6 *per cent. per ann.* compound interest? *Ans.* £504 : 19 : 9

3. What will 480l. amount to in 6 years at 5 *per cent per ann* compound interest? *Ans.* £643 : 4 : 10

4. What will 500l. amount to in 4 years, at $4\frac{1}{2}$ *per cent. per ann.* compound interest? *Ans.* £590 : 11 :

5. What is the compound interest of 400l. 10s. at $3\frac{1}{2}$ *per cent. per ann.* for 3 years? *Ans.* £43 : 10 : 9

Note, See more of Compound Interest in Decimals.

Of REBATE or DISCOUNT.

WHAT is Rebate or Discount?

A. Rebate or Discount is when a sum of money
at any time to come, is satisfied by paying so much
sent money as being put out to interest, would amount
he given sum in the same space of time.

Q. How is the operation performed?

A. 1. As 12 months :
Are to the rate *per cent.* : :
So is the time proposed :
To a fourth number.

2 Add that fourth number to 100l.

3. As that sum :
Is to the fourth number :
So is the given sum :
To the rebate.

4 Subtract the rebate from the given sum, and the remainder is the present worth, or thus,

5. As that sum :
Is to 100l : :
So is the given sum :
To the present payment.

6. Subtract the present payment from the given sum, and the remainder is the rebate.

Q. How do you prove questions in rebate?

A. Find the amount of the present payment at the time and *per cent.* given, and that will be equal to the given sum.

Examples.

. What is the rebate of 795l. 11s 2d. for 11 months, at
r *cent.*? *Ans.* £41 : 9 : 5 : $3\frac{1572}{5532}$ *qrs.*

. What is the present worth of 161l. 10s. for 19 months,
per cent.? *Ans* £149 : 13 : $0\frac{3}{4}$.

. Sold goods for 795l. 11s 2d. to be paid 4 months
ce,—what is the present worth, at $3\frac{1}{2}$ *per cent*?
Ans. £786 : 7 : $8\frac{1}{4}$.

. What is the present worth of 4000l payable in 9
ths, at $4\frac{3}{4}$ *per cent*? *Ans.* £3862 : 8 : $0\frac{1}{2}$.

. How much ready money for a note of 18l due 15
ths hence, at 5 *per cent.*? *Ans* £16 : 18 : 10.

. Suppose 810l. were to be paid 3 months hence, allowing
cent. discount,—what must be paid in hand? *Ans.* £800.

7. If a legacy of 1000l. is left me July 24, 1786, to b paid on the Chriſtmas-day following;—what muſt I r ceive, when I allow 6 *per cent.* for preſent payment?

Anſ. £975 : 3 :

8. Being obliged by a bond, bearing date Auguſt 2 1791, to pay next Midſummer (which is leap year) 31 —what muſt I pay down if they allow diſcount after th rate of 8 *per cent.*? *Anſ.* £305 : 16 : 6

9. Sold goods for 312l to be paid at two three month (that is, half at 3 months, and the other half at 3 mont after that) – what muſt be diſcounted for the preſent pa ment, at 5 *per cent.*? *Anſ.* £5 : 14 :

10 Sold goods for 300l. to be paid at three two month (that is, one third at 2 months, one third at 4 months, a one third at 6 months)—what muſt be diſcounted for pr ſent payment at 4 *per cent.*? *Anſ.* 3 : 18 :

11. What is the preſent worth of 100l at 5 *per c* payable at two four months? *Anſ.* £97 : 11 :

12. I would know the preſent worth of 150l payable three four months at 5 *per cent* diſcount? *Anſ.* £145 : 3

13. What is the preſent worth of 200l at 4 *per cent.* p able as follows, viz. 100l. at two months; 50l. at 3 mon and 50l. at 5 months? *Anſ.* £198 : 0

OF EQUATION OF PAYMENTS.

The common Way.

Q. WHAT is Equation of Payments?

A. When ſeveral ſums of money, to be p at different times are reduced to one mean time for the p ment of the whole, without loſs to debtor or creditor, th called equation of payments.

Q. Wherein may the debtor or creditor be ſaid to ſu loſs, when the debt is paid.

A. 1 When one mean time is aſſigned for the paymen the whole debt, and the money is not paid till ſome time terwards; then the debtor ſuffers loſs by lying not only of the principal, or ſum due, but alſo the intereſt of that for the time of forbearance, at 3, 4, or more *per cent.* as ſhall agree. Likewiſe, if the money be paid before due, then the creditor ſuffers loſs by allowing ſo much *cent.* by agreement, for the time of prompt payment.

2. The loss to either party may be in reducing the several times of payment to one, which is not the true equated time; and then if the payment be made after the true time, the creditor suffers loss, because he receives no interest for it: If the time agreed on be before the true time, then the debtor suffers loss, because he receives no interest for his early payment.

Q. How is the operation wrought?

A. Multiply each payment by its time, and divide the sum of all the products by the whole debt, the quotient is the equated time.

Examples.

1. A owes B 100l whereof 50l. is to be paid at 2 months, and 50l. at 4 months; but they agree to reduce them to one payment; when must the whole be paid? *Ans.* 3 *months.*

2. A merchant hath owing him 300l. to be paid as follows, 50l. at two months, 100l at 5 months, and the rest at 8 months; and it is agreed to make one payment of the whole; —I demand when that time must be? *Ans* 6 *months.*

3. F owes to H 1000l whereof 200l is to be paid present, 400l. at 5 months, and the rest at 10 months, but they agree to make one payment of the whole;—I demand the equated time? *Ans.* 6 months.

4. K is indebted to L a certain sum, which is to be discharged at four several payments, that is $\frac{1}{4}$ at 2 months, $\frac{1}{4}$ at 4 months, $\frac{1}{4}$ at 6 months, and $\frac{1}{4}$ at 8 months; but they agreeing to make but one payment of the whole, the equated time is therefore demanded? *Ans* 5 *months*

5. H bought of X a quantity of goods upon trust, for which H was to pay $\frac{1}{5}$ of the debt every 3 months, till the whole should be discharged; but they afterwards agreed to pay the whole at one equated time, the time is demanded? *Ans.* 6 months.

6. W owes Z a sum of money, which is to be paid $\frac{1}{2}$ present, $\frac{1}{4}$ at 4 months, and the rest at 8 months,—what is the equated time for the whole? *Ans.* 3 *months.*

7. P owes Q 420l. which will be due 6 months hence; but is willing to pay him 60l now, provided he can have the rest forborn a longer time; It is agreed on; the time of forbearance therefore is required? *Ans.* 7 *months.*

Note, this question is in reverse proportion. See more of this Rule in Decimals.

Of BARTER.

Q. WHAT is Barter?

A. Barter is the exchanging of one commod for another, and informs merchants so to proportion th quantities, as that neither may sustain loss.

Q. How do you prove questions in Barter?

A. By changing the order of them.

Examples.

1. How much sugar at 9d *per* lb. must be given in bar for $6\frac{1}{2}$ cwt. of tobacco, at 14d. *per* lb ? *Ans.* 10 *cwt.* 11

2. What quantity of tea, at 10s *per* lb. must be given barter for 1 cwt of chocolate, at 4s *per* lb ?

Ans. 44 *lb* $12\frac{8}{10}$

3 How much rice at 28s *per* cwt. must be bartered f $3\frac{1}{2}$ cwt of raisins, at 5d. *per* lb? *Ans* 5 cwt. 3 qrs. $9\frac{111}{336}$

4. A and B bartered: A had 5 cwt. of sugar, at 6d lb. which he gave to B for a quantity of cinnamon, at 10s. *per* lb — I demand how much cinnamon B gave A?

Ans. 26 *lb.* 4

5. B delivered 3 hhds of brandy, at 6s. 8d *per* gallon, C for 126 yards of cloth :—what was the cloth *per* yard?

Ans.

6. A and B bartered: A had 12 cwt. of sugar, worth *per* lb. for which B gave him $1\frac{3}{4}$ cwt. of cinnamon;—I de mand how B rated his cinnamon *per* lb? *Ans.* 27d $1\frac{140}{196}$

7. A hath linen cloth worth 20d. an ell ready money; b in barter he will have 2s. B hath broad cloth worth 14s. 6 *per* yard ready money,—at what price ought the broad clo to be rated in barter? *Ans.* 17*s* 4*d.* $3\frac{4}{10}$*qrs. per* ya

8. A and B bartered: A had 41 cwt. of hops, at 30s *p* cwt. for which B gave him 20l in money, and the rest prunes, at 5d. *per* lb.—I demand how many prunes B ga A, besides the 20l ? *Ans.* 17 *cwt.* 3 *qrs.* 4

9. C hath candles, at 6s. *per* dozen ready money; but barter he will have 6s 6d *per* dozen; D hath cotton at 9 *per* lb. ready money;—I demand what price the cotton mu be at in barter; also how much cotton must be bartered f 100 dozen of candles?

Ans. The cotton is 9*d.* 3 *qrs. per lb. in barter, and cwt.* 16*lb. of cotton must be given for* 100 *dozen candles.*

Of LOSS and GAIN.

WHAT is Loss and Gain?

A. Loss and Gain is a rule which teacheth mer-
ants what they shall gain or lose in the sale of their goods, ving the price that they bought them for, and the price for ich they are to be sold, both known.

Q. How are the following questions proved?

A. Let them be varied.

Examples.

1 Bought 18 cwt. of cheese, at 28s *per* cwt. which I sell out ain at $3\frac{1}{2}$d *per* lb. what is the profit of the whole? *An.* £4:4*s*.

2. If I buy deals at 20d. a piece, and sell them again at d.—what shall I lose by 120 dozen? *Ans.* £18.

3. Hats bought at 4s. a-piece, and sold again at 4s. 9d.—
hat is the profit in laying out 100l.? *Ans.* £18 : 15.

4 Bought 19 fother of lead, at 14s. *per* cwt.—what is ined by the whole, sold out at 4d. *per* lb? *Ans.* 432 : 5*s*.

5. Bought 60 reams of paper, at 15s *per* ream—what is loss in the whole quantity, at 4 *per cent.*? *Ans.* £1 : 16*s*.

6. Bought 7 tons of wine, at 17l. *per* hhd. which I sell ain at 1s. *per* pint, I demand the whole gain, and the gain *cent.* *Ans.* £229 : 12*s*. *whole gain; and* £48 : 4 : 8 1 *qr* $\frac{420}{476}$ *the gain per cent.*

7. If I sell 500 deals at 15d. a piece, and 9l. *per cent* loss; what do I lose in the whole quantity? *Ans.* 2 : 16 : 9.

8. Bought 3 oxen for 24l. 10s. which I sell again for 2s. stone;—what ought the 3 oxen to weigh together, the les and offal being the only clear gain? *Ans.* 245 *stone*.

9. A draper bought 100 yards of broad cloth, for which gave 56l—I desire to know how he must sell it *per* yard gain 19l. in the whole? *Ans.* 15*s*. *per yard.*

10. A draper bought 100 yards of broad cloth for 56l.—
emand how he must sell it *per* yard to gain 15l. in laying 100l.? *Ans.* 12*s*. 10*d*. 2 *qrs*. $\frac{24}{100}$.

Of FELLOWSHIP.

HOW many sorts of Fellowship are there?

A. Two; Single and Compound.

Of Single Fellowship.

Q. What is Single Fellowship?

A. Single Fellowship is when the stocks of each partner ntinue for an equal term of time.

Q. What is the rule?

A. As the sum of the several stocks,
Is to the total gain or loss:
So is each man's share in stock,
To his share of the gain or loss.

Q. How is this Rule proved?

A. Add all the shares together, and the Sum will be equ to the given gain or loss.

Note. This way of proving Fellowship will not hold good always: For an error should be committed in the beginning of the work and carri on through the whole operation, yet the same will prove, though man's share of the gain or loss assigned him by that operation, be eith more or less than his true share. The most exact method, then th would propose, though something more tedious, is to change the or of the question, and put each man's share of the gain or loss in the pla of his stock first laid out, and make the sum of the stocks stand in t place of the whole gain or loss, and then it will be,

As the total gain or loss
Is to the sum of the several stocks:
So is each man's share of the gain or loss
To his particular share in stock.

Q. What else doth this rule belong to beside Fellowshi

A. By it the estate of a bankrupt may be divided amo his creditors: Also legacies may be adjusted, when there i deficiency of assets or effects.

Examples.

1. A and B were sharers in a parcel of merchandise, in purchase of which, A laid out 3l. and B 7l. and the comm dity being sold, they find their clear gain amounts to —what part of it must each man have?

An. A must have 7s. 6d. ; *and B* 17s.

2. A, B, and C, trading together, gained 120l. which i be shared according to each man's stock; A put in 14 B 3000l. ; and C 160l. ; — what is each man's share?

Ans. A 28l. *B* 60l. *C*

3. Three merchants trading to Virginia, lost goods to value of 800l. Now if A's stock was 1200l. ; B's 480 and C's 2000l.—what sum did each man lose?

Ans. A lost 120l. ; *B* 480l. *C* 20

4. Three merchants traded together, and they put into common stock 1000l. each man, and gained 600l.— h much must each man have? *Ans.* £200 *each*

5 Four men traded with a stock of 800l and they ga in two years time twice as much and 40l. over: A's was 140l ; B's 260l ; C's 300l.—I demand D's stock; what each man gained by trading? *Ans. D's stock was* 10 *and A gained* 287l. ; *B* 533l. ; *C* 615l. ; *and D*

6 A, B, and C, trading to Guinea with 480l.; 680l.; and 840l. in three years time did gain 1010l. how much is each man's share of the gain?

Ans. A 242*l.* 8*s*; *B* 343*l.* 8*s*; *C* 424*l.* 4*s*.

7. D, E, and F, freighted a ship from the Canaries to England, with 108 tuns of wine, of which D had 48; E 36; C 24; but by reason of bad weather, they were obliged to cast 45 tuns overboard; how much must each man sustain of the loss? *Ans. D* 20 *tuns*; *E* 15 *tuns*; *F* 10 *tuns*.

8. A merchant is indebted to S 70l; to T 400l; to V 140l. 12s. 6d.; but upon his decease, his estate is found to be worth no more than 409l. 14s how must it be divided among his creditors?

Ans.	*S must have*	£46 : 19 : 3*d*	3 *qrs*	$\frac{142750}{146550}$
	T -	268 : 7 : 7	1	$\frac{77250}{146550}$
	V -	94 : 7 : 0	2	$\frac{74100}{146550}$

9. If the money and effects of a bankrupt amount to 1400l. 14s 6d. and he is indebted to A 742l. 12s; to B 641l. 19s. 8d; and to C 987l. 19s. 9d. how must it be divided among them?

An.	*A must have*	£438 : 8 : 4*d*	1 *qr.*	$\frac{303527}{569417}$
	B -	379 : 0 : 3	3	$\frac{158361}{569417}$
	C -	583 : 5 : 9	3	$\frac{107529}{569147}$

Of Compound Fellowship.

Q. What is Compound Fellowship?

A. Compound Fellowship is when the stocks continue in an unequal term of time.

Q. What is the Rule?

A. 1 Multiply each man's stock and time together.

2. Add the several products thence arising together.

3. As the sum of those products,
Is to the whole gain or loss:
So is each product,
To its share of the gain or loss.

Q. How is this rule proved?

A. As in Single Fellowship.

Examples.

1. Three merchants traded together: R put in 120l. for 9 months; S 100l. for 16 months; and T 100l. for 14 months; and they gained 100l. how must it be divided?

An.	*R must have*	£26 : 9 : 4*d.*	3 *qrs*	$\frac{3120}{4080}$
	S -	39 : 4 : 3	3	$\frac{240}{4080}$
	T	34 : 6 : 3	1	$\frac{720}{4080}$

2. Three merchants join in trade; F put in 400l. for 9 months; G 680l. for 5 months; and H 120l. for 12 months; but by misfortunes lost goods to the value of 500l. what must each man sustain of the loss?

$$An.\begin{cases} F \text{ must lose } £213 : 5 : 4d \ 3 \ qrs \ \frac{2840}{8440} \\ G \quad - \quad 201 : 8 : 5 \quad 0 \quad \frac{7840}{8440} \\ H \quad - \quad 85 : 6 : 1 \quad 3 \quad \frac{6200}{8440} \end{cases}$$

3 D, E, F, hold a pasture in common, for which they pay 20l *per annum*. In this pasture D had 40 oxen for 76 days, E had 36 oxen for 50 days, and F had 50 oxen for 90 days. I demand what part every one of these tenants ought to pay of the 20l.

$$An.\begin{cases} D \text{ ought to pay } £6 : 10 : 2d. \ 1 \ qrs \ \frac{2340}{9340} \\ E \quad - \quad 3 : 17 : 1 \quad 0 \quad \frac{2000}{9340} \\ F \quad - \quad 9 : 12 : 8 \quad 2 \quad \frac{5000}{9340} \end{cases}$$

OF EXCHANGE.

Q. WHAT is Exchange?

A. Exchange is the giving the money, weight, or measure of one country, for the like value in bills, money, weight, or measure of another country.

Q. What is the course of Exchange?

A. It is the value of money agreed on among merchants.

Q. Is the course of Exchange always the same?

A. No: The Course of Exchange rises or falls almost every day, according as money is plenty or scarce; or according to the time allowed for payment of the money in exchange; and then the value is said to be above or under *Par*.

Q. What is the Par of Exchange?

A. It is the intrinsic value of any foreign money compared with sterling money.

Q. What is the Agio?

A. It is a term used in some countries abroad, especially in Italy, but never in England; and signifies the difference between the value of bank notes, or bank money, and current money in such places; that is, it is the difference between the best money, used in the terms of Exchange, and the worst, used in payment for goods.

Q. What is meant by Bank Notes, or Bank Money?

A. Bank Notes are obtained from foreign bankers for money lodged in their banks, which money is called Bank Money.

Q. What is Current Money?

A. It is such as passes from hand to hand, in the receiving and paying such sums as are due from one man to another, commonly called Running Cash.

Q. What is usance?

A. It is a certain time allowed for the payment of bills of Exchange; but different according to the usage or custom of the place where the bill is made, compared with the distance of that place on which the bill is drawn; that is, the nearer the place on which the bill is drawn, is to the place where it was drawn, the time is the shorter; but the further those places are from each other, the length of the time allowed for the payment of that bill, from the date of it is the greater.

Note, Bills are payable five ways, *viz*

1. At sight
2. At so many days after sight
3. At usance, or a certain length of time agreed on between the two places.
4. At double usance, which is double the time agreed on between the two places.
5. At marts or fairs, which is to be understood at some certain days accounted for fairs in the same places where the bills are made payable.

Q. What are Days of Grace?

A. In London it is customary to allow three days to the time mentioned in the Bill, which are called Days of Grace, on the last day of which (if it be not on a Sunday, but if it is, on Saturday) the bill must be demanded, and if not then paid, must be immediately protested.

Note, In some places they allow a larger number of days of grace, than we do at London, and in others none at all

Q. How are questions in Exchange proved?

A. By changing the order of them

Case I.

Q. What places does London exchange with in dollars, or pieces of eight of Mexico?

A. With Madrid and Cadiz, in Spain, and with Genoa, and Leghorn in Italy.

Q. How do they keep their accompts in Spain?

A. In Rials and Marvedies.

Note, 37 2 Marvedies make 1 Rial
8 Rials. - - 1 Piece of eight

Q. What is the Par of Exchange between London and Spain?

A. The Par of the Money between London and Spain is that 1900 rials are exactly equal to 51l. sterling: consequently 1 rial is worth 6d. 1 qr $\frac{71}{95}$.

Note, 1 Spain gives to London 1 dollar, or piece of eight for an uncertain number of pence sterling.
2. In Spain they allow 14 days of grace.

Q. How do they keep their accompts in Italy?

A. In livres, sols, and deniers; some few cities excepted

Note, 1, 12 Deniers make 1 sol.
20 Sols, make 1 livre
5 Livres make 1 Piece of eight of Geneva.
6 Livres, 1 Piece of eight at Leghorn.

2. The usance of Genoa to London is 3 months after date.
3. At Genoa they allow 30 days of grace.

Examples.

1. What is the amount of 63l. sterling in pieces of eight, at 56d *per* piece? *Ans.* 270 *pieces of eight*

2 A factor hath sold goods at Cadiz for 1468 pieces of eight at 4s. 8d. 2 qrs *per* piece, how much sterling is the sum? *Ans* £ 333 : 7 : 1

A Bill of Exchange *viz* Leghorn on London.

Leghorn, July 31, 1791, for 786 pieces of Eight of Mexico, at 55d sterling per Piece of Eight, at 3 months.

" Three months after date, pay this my first of Exchange
" to Mr. James Le Morte, or order, seven hundred and
" eighty-six pieces of eight of Mexico, for the Value re-
" ceived of himself, at 55d. sterling *per* piece, and place it
" to accompt, as *per* advice from

To Mr. William Matthew, merchant, in London. } " Your humble servant, JAMES DOUGLAS"

How much money must be received in England for this Bill? *An.* £180 : 2 : 6

Case II.

Q. What places does London exchange with in Ducats?

A. With Venice in Italy.

Note, 6 Solidi make 1 Gross.
24 Grosses — 1 Ducat

Q. What is the Par of exchange between London and Venice?

A. One hundred livres are worth three pounds sterling.

Q. How many sorts of Ducats are there at Venice?

A. Two sorts, viz. Ducats Banco, or Bank Ducats, which are usually given in Exchange; and Ducats Picoli, or Current Ducats, which are usually bargained for and paid in the purchase of goods and merchandize, and are 20 *per cent.* worse than the Bank Ducats.

Note, 1, The par of the ducat banco, is 52 pence sterling; and the par of the ducat picoli is 40d sterling.

2 The usance of Venice to London and back again is 3 months, or 90 days after date; two usance is that time doubled.

Examples.

1. If 100 Livres are worth 3l. sterling,—what is 1 livre worth? *Ans.* 7d $\frac{1}{5}$ *sterling*

2. There are 2000 ducats, at 4s. 4d each, remitted to London, to be paid in pounds sterling, what is the amount?

Ans £433 : 6 : 8.

3. A bill of 100l. sterling is remitted to Venice, to be paid in ducats at 4s 4d, each; what is the amount?

Ans. 461 $\frac{28}{52}$ *ducats.*

4. A traveller would exchange 233l. 16s. 8d. sterling for Venice ducats, at 4s. 9d. *per* ducat; how many must he have?

Ans. 984 $\frac{32}{57}$ *ducats.*

A Bill of Exchange, *viz.* Venice on London.

Venice, August 17*th*, 1791, for 4000 *Ducats Banco, at* 54$\frac{1}{4}$*d. sterling per Ducat, at usance.*

"At usance, pay this my first Bill of Exchange to Mr. Abraham Jennings, or order, four thousand ducats, at fifty-four pence farthing sterling *per* ducat, value received, and place it to accompt of

To Samuel Jones, Esq. Merchant in London, } "Your humble servant, "WILLIAM SHERSTON."

I demand the value of this bill in sterling money?

Ans. £904 : 3 : 4.

Another, *viz.* London on Venice

London, September 14, 1791, *for* 904*l.* 3*s.* 4*d. sterling, to be paid at Venice, in Ducats, at* 54$\frac{1}{4}$*d, sterling per ducat Banco, at Usance.*

"At usance, pay this my second bill of exchange, my first not paid, to Mr. Samuel Dobbins, or order, nine hundred and four pounds three shillings and four pence sterling, in ducats at fifty-four pence farthing per ducat, value in myself, and place it to accompt as *per* advice from

To Mr. James Torriano, merchant at Venice. } "Your humble Servant, "MICHAEL TASSIO."

What is the value of this bill in ducats banco?

Ans 4000 *ducats.*

Case III.

Q. What places does London exchange with for French Crowns?

A. With Paris, Lyons, Rouen, &c. in France.

Q. How do they keep their accompts in France?

A. In Livres, Sols and Deniers.

Note 1. 12 Deniers make 1 Sol
20 Sols make 1 Livre.
3 Livres make 1 Crown.

2. The Livre is imaginary

3. By an order of Lewis XV. their money is brought to the English standard for the benefit of trade.

Q. What is the Par of Exchange between London and France?

A. One livre is worth 18d. sterling; and one crown is worth 4s 6d. sterling.

Note In France they allow 10 days of grace; but when bills are drawn at sight, they are payable the same day.

2. The usance between France and London is one month, consisting of 30 days.

Examples.

1. A bill of 200l. is remitted to Paris by a merchant in London; what is the value in French crowns, at 4s. 6d. each? *An* $888\frac{48}{54}$ *crowns*

2. There are 800 French crowns, at 4s. 6d. each remitted to London by a merchant in Paris; what is the value in pounds sterling? *An.* £180 *sterling*

A Bill of Exchange, *viz.* Paris on London.

Paris, September 17, 1793, *for* 1000 *Crowns, at* 4*s.* 2*d.* at 2 *usance.*

"At double usance, pay this my second bill of exchange,
" my first not paid, to Mr. James Jackson, or order, the
" sum of one thousand crowns, at four shillings and two
" pence *per* crown, value received, and place it to accompt,
" as *per* advice of

To Mr. Simon Surepay, } " Your humble servant,
London. } " DANIEL ARBOTT."

What is the value of this bill in sterling money?

Ans. £ 208 : 6 : 8

Case IV.

Q What places does London exchange with for Mill-reas?

A. With Oporto and Lisbon, &c. in Portugal; and with the Island of Madeira.

Q. How do they keep their accompts in Portugal?

A. In Reas.

Note. 1, 1000 reas make 1 mill-rea.

2. They separate the reas from the mill-reas by some particular mark thus, 687 ⊖ 496, that is 687 mill reas and 469 Reas which is the same with 687496 Reas

3. Very near 14 Reas or $13\frac{1}{3}$ reas make one penny English.

Q. What is the Par of Exchange between London and Portugal?

A. One Mill-rea is worth 5s $7\frac{1}{2}$d. which appears thus:

800 Reas (or 8 Testoon Piece) are	= 4s.	6d.
200 Reas (or fourth Part)	= 1	$1\frac{1}{2}$
1000	5	$7\frac{1}{2}$

Note. The usance between London and Portugal is two months, or 60 days after date.

Examples.

1. If a bill is drawn from Lisbon of 1432 mill-reas, at . 8d. *per* piece;—how much English money is that bill?

Ans. £ 477 : 6 : 8.

2. If a bill be drawn from London of 1333l. 6s. 8d. ster- ng, how much is it at Lisbon in mill-reas, at 6s. 8d. each?

Ans. 4000 *mill reas.*

A BILL of EXCHANGE, *viz.* LISBON on LONDON.

isbon, October 14, 1791 *for* 4761 ⊛ 764 *at* 5*s.* 8*d. at usance.*

"At usance pay this my first of exchange to Mr. Henry Sozomon, or order, four thousand seven hundred and sixty-one mill-reas, seven hundred and sixty-four reas, at five shillings and eight-pence sterling *per* mill-rea, value receiv-ed; and place it to the accompt of

Mr. Jacques Joliffe, merchant in London. "Your humble servant, "JOHN MINORS."

What is the value of this bill in sterling money?

Ans. £1349 : 3 : 3d 3 *qrs.* $\frac{808}{1000}$.

Case V.

Q. What place does London exchange with for Ducatoons, owns, or Ecues?

A. With Florence, in Italy.

Q How do they keep their accompts in Florence?

A. In ecues, sols, and deniers picoli, or current.

Note, 12 Deniers make 1 sol.
20 Sols make 1 ecu. crown or ducatoon

Q. What is the Par of Exchange between London and orence?

A. One ecu, crown or ducatoon is worth 60d. sterling.

te, The usance between Florence and London, is 3 months or 90 days fter date.

EXAMPLES.

1. A bill of 120 ducatoons is remitted from Florence, at d. each; what is the value in pounds sterling?

Ans. £26 : 10*s.*

2. A Bill of 120l. 16s. 8d is drawn from London;—what he value at Florence in ducatoons, or ecues, at $53\frac{1}{2}$d. h?

Ans. 990 $\frac{70}{107}$ *ecues.*

A BILL of EXCHANGE, *viz.* FLORENCE on LONDON.

rence, October 17, 1791, *for* 1876 *Ecues, at* 63*d. sterling* per *Ecu, at usance.*

"At usance, pay this my third of exchange, my first and econd not paid, to Mr. Jonathan Farmento, or order, one thousand 876 ecues, at 63d. sterling; *per* ecu, value eceived, and place it to the accompt of

Mr John Jameson, "Your humble servant,

What is the value of this bill in sterling money?

Ans. £492 : 9

Case VI.

Q. What place does London exchange with for Florins?

A. With Frankfort, in Germany.

Q. How do they keep their accompts in Frankfort?

A. In Goulds, Cruitzers and Deniers, or Fennings.

Note. 8 Fennings, or 4 Deniers make 1 Cruitzer.
60 Cruitzers make 1 Gould or guilder.

Q. What is the Par of Exchange between London and Frankfort?

A. Twenty florins are equal to 3l. sterling.

Note, When they exchange or negotiate bills for London, Holland, or Flanders, the bills are paid in goulds of 65 cruitzers; and for France, Hamburgh, and Italy, in goulds of 60 cruitzers; and sometimes in rix-dollars, at 4s. 6d. sterling, and at so much per cent, profit or loss.

Examples.

1. If 20 florins are equal to 3l. sterling, what is the worth of 1 florin? *Ans.* 3s. *sterling.*

2. If 1000l. sterling be remitted to Frankfort, what is the value in florins at 39d. per piece? *Ans* $6153\frac{11}{39}$ *florins.*

3. If 100 florins at $40\frac{1}{2}$d each, be remitted from Frankfort to London, what is the value in pounds sterling?

Ans. £16 : 17 :

A Bill of Exchange, *viz.* London on Frankfort.

London, September 12, 1791, for 763l. 10s. sterling to be paid in Florins, at 41d sterling each, at usance.

"At usance, pay this my second of exchange, my first
"not paid, to Mr. Jacobus Sanderson, or order, seven hun-
"dred and sixty-three pounds ten shillings sterling, in florins
"at 41d sterling *per* florin, value received, and place it to
"accompt as *per* advice from

To Mr William Maron, merchant, in Frankfort. "Your humble servant, "JAMES JOHNSON.

What is the value of this bill in florins?

Ans. $4469\frac{11}{41}$ *florins.*

Case VII.

Q. What places does London exchange with by the pound Flemish or pound sterling?

A. With Antwerp, Brussels, Amsterdam, Rotterdam, and all parts of the Spanish and United Provinces. Also with Hamburgh in Germany.

Q. How do they keep their accompts in these places?

A. Some in pounds, shillings and pence, as in England; and others in guilders, stivers and pennies.

Note 1. 16 Pennies make 1 Stiver
20 Stivers 1 Guilder. Also
6 Stivers 1 Shilling
6 Guilders 1 Pound Flemish.

2. The Par of Exchange between London and Holland is that £9 sterling are equal to 100 florins.

3. A florin is worth 3s 2d, $\frac{2}{7}$ Flemish.

4. The Prices of the Exchange at London, Hamburgh and Amsterdam, are said to have a very great influence upon all the rest of Europe.

Q. What is the Par of Exchange between London and Antwerp?

A. Sixteen pounds Flemish are equal to nine pounds sterling: So that 1l. Flemish is equal to 11 shillings and 3 pence sterling, and 1l sterling is equal to 35s. 6d $\frac{2}{3}$ Flemish.

Examples.

1. Being desirous to remit to my correspondent at London, the sum of 2000l 12s 6d Flemish, to dispose of according to my order, exchange at 34s 6d Flemish *per* pound sterling; —how much money sterling shall I be creditor for in the city of London aforesaid? *An* £1159 : 15 : 7*d* 3 *qrs.* $\frac{120}{414}$.

2. My correspondent in England gives me notice that he has disbursed in merchandize upon my account, the sum of 1000l sterling;—what sum must I answer for that in Holland, the course of Exchange being at 33s 5d. Flemish for one pound sterling? *An.* £1666 : 13 : 4 *Flemish.*

Note When the course of Exchange is at 33s, 4d Flemish for 1 pound Sterling, then to bring Flemish money into English money, multiply the Flemish money by 3 and divide that product by 5 the quotient will give the Answer, in pounds sterling, and the contrary

3. My correspondent in Rotterdam sends me word, that he has disbursed upon my account the sum of 3060 guilders and 15 stivers —what sum must I answer for that at London, the course of Exchange being at 37s. 9d. Flemish *per* pound sterling? *An.* £270 5*s.* 3*d.* 2 *qrs.* $\frac{138}{453}$.

Note A Stiver is 2d. Flemish and a Guilder 40d.

4. A merchant delivered at London 120l. sterling, to receive 147l Flemish in Amsterdam;—how much was 1l. valued at in Flemish money? *An* £1 : 4 : 6.

5 If 1 florin is worth 3s. $2\frac{2}{7}$d, Flemish and 100 florins are equal to 9l. sterling; how much is the real worth of 1l. sterling in Flemish money? *An.* 35s. 6*d* $\frac{6}{9}$.

As 1 fl : 3s. $2\frac{2}{7}$d. : : 100 fl : 16l. Flem.

As 9 : 16 0 : : 1 35s. $6\frac{6}{9}$ Flem.

Of reducing the current money of Holland into Bank-money, and the contrary.

Examples.

1. Being in Holland, I have 1000 guilders, current money, which I would turn into Bank money, the agio being at 5 guilders *per cent.* how much is it?

Ans 952 *guilders, banco,* $\frac{40}{105}$

G Cur. G. B. G.Cur. G. B.

As 105 : 100 : : 1000 : 952 $\frac{40}{105}$.

2. My correspondent in Amsterdam having wrote me word that he had by him of mine 2763 guilders, 15 stivers currency, I have directed him to turn the same into Bank-money, the agio being (as I am informed) 5½ guilders *per cent.* I demand how much Bank-money it will make?

Ans 2619 *guilders,* 13 $\frac{77}{211}$ *stivers Bank-money.*

G. Cur. G. B. G S Cur. G B St.

As 105½ : 100 : : 2763 ,, 15 : 2619 13 $\frac{77}{211}$

3. Holland is indebted to London 7681 guilders current money, and would know him much sterling it will amount to, exchange at 35s 6d. banco *per* pound sterling, agio at 5 *per cent.*—how much is it? *Ans* £ 686 : 17 : 6*d.* $\frac{60}{420}$ sterling.

G C. G. B°. G C. G. B°. St Pen.

As 105 : 100 : : 7681 : 7315 4 12 $\frac{20}{105}$.

s. d. l. St G B°.St.Pen

As 35 : 6 : 1 : : 7315 5 12 : £686 : 17 : 6*d* 1 *qr.*

4. Amsterdam remits to London 1090 guilders, 17½ stivers, at 33s. 8d. banco *per* pound sterling;—what will this remittance amount to at London in sterling money?

Ans. £ 108 : 0 : 1*d.* 3 *qrs.* $\frac{52}{404}$ *sterling.*

Note The above money is supposed to be reduced into bank-money already.

s. d. l. St. G St. B°.

As 33 8 : 1 : : 1090,, 17½ : £108 : 0 : 1d. 3 qrs. $\frac{52}{404}$.

Of the Sale of Gold in Holland.

Note All gold is bought and Sold at Amsterdam by weight; that is, 355 guilders current per mark of that weight.

Examples.

A merchant in London sends over to his correspondent at Amsterdam 1000 moidores, valued at 27s sterling each: the charges on shipping came to 5l. 19s. 6d. When they came to the place consigned, and were weighed, they amounted to 14209 guilders 14 stivers currency, all charges there deducted;—I demand what was their value in English money.

nd how much the London merchant gained or lost by his moidores admitting the agio to be 5 guilders *per cent.* and the course of exchange 33s. 6d. B° Flemish *per* pound sterling

Ans. £12 : 15 : 4 *loss.*

1. 1000 Ms. + 5l. 19s. 6d. = 1355l. 19s 6d.
   G. G G. St. G. St.

2. As 100 : 5 : : 14209 „ 14 : 710 „ 9
   Gu. St Gu St. Gu. St.

3. As 14209 „ 14 — 710 „ 9 = 13499 „ 5
   s. d. l. G. S. l. s. d.

4. As 33 6 : 1 : : 13499 „ 5 : 1343 4 2

5. 1355l. 19s. 6d — 1343l 4s. 2d. = 12l 15s 4d.

A Bill of Exchange *viz* London on Rotterdam.

London, September 14, 1793, *for* 436*l.* 17*s. sterling, at* 34*s.* 6*d. Flemish per pound sterling, at usance.*

" At usance, pay this my first of exchange, to Jacob Van " Hoove, or order, four hundred and thirty-six pounds " seventeen shillings sterling, value received of William John- " son, Esq; and place it to accompt, as *per* advice from

To Mr. James Juliers, } " Your humble servant,
merchant, Rotterdam. } " THOMAS CARTWRIGHT.

What is the value of this bill in Flemish money?

An. £753 : 11 : 3 : 3 *qrs.* $\frac{12}{20}$.

Also in guilders and stivers? *An.* 4521 *guil.* 7 *stiv.*

s.	d.	l.	s.
34	6	436	17
12			414
414		1747	8
		4368	5
		174740	0

Gu. St.

4|0)18085|5 13(4521 7 *An.*
15

Another, *viz.* Rotterdam on London.

Rotterdam, September 19, 1793, *for* 7693 *guilders,* 17 *stivers, at* 35*s.* 6*d. Flemish per pound sterling.*

" At usance, pay this my second bill of exchange, my first not paid, to James Truelove, or order, seven thousand six hundred and ninety-three guilders seventeen stivers at 35s. 6d. Flemish per pound sterling, value received of Jacques Jacobson, and place it to accompt, as *per* advice from

To James Jolles, Esq; } " Your humble servant,
merchant, at London. } " Johannes Van Schooten."

What is the value of this bill in sterling money?

To know how much is gained or lost per cent. on the rising or falling of the price of Exchange.

Examples.

1. London draws upon Holland, for any sum of money, exchange at 35s. 6d. Flemish *per* pound sterling; in three weeks or a month afterward London draws on Holland again, exchange at 34s 6d —I demand what London gains *per cent.* by this negotiation? *An.* £2 : 17 : 11 : 2 *qrs.* $\frac{252}{414}$ *gain*

s. d. s. l. l. s. d. qrs.
As 34 6 : 1 : : 100 : 2 17 11 2$\frac{252}{414}$.

2. London draws upon Amsterdam, exchange at 34s. 6d. Flemish *per* pound sterling; and in five weeks time draws again the exchange being at 35s. 6d—how much is lost *per cent.* by this transaction? *An.* £2 : 17 : 11 : 2 *qrs* $\frac{252}{414}$

Note, Hence it is to be observed, that the lower the Price of Exchange is, the greater is the gain at London, and the contrary when it is higher. But the case is just the reverse at Holland.

Case VIII.

Q. What places does London exchange with by the pound sterling or pound currency?

A. In all the British dominions in America, in the West Indies, and in Ireland.

Q. How do they keep their accompts in these places?

A. As they do in London, that is, in pounds, shillings, pence, and farthings; but with this difference, that in London they call their money sterling, but in all the Western dominions they call it currency.

Q. Why is the money called Currency in the Western dominions?

A. Because they have very few coins of any sort circulating among them, excepting in the English Islands there; and therefore are obliged to deal in what they call paper money.

Note. 1, Notes of hand pass currently among the people: and in New England they are said to be given for so small a sum as five shillings. Now as this paper money is subject to many casualties, it causes a very great undervalument of their currency, and is sometimes and in some places, at 6 or 700 pounds currency for 100 pounds sterling, or money that is good silver or gold.

2. In all the English islands in the West Indies, they have so great plenty of foreign coins, that their currency is sometimes at no greater discount than 25 *per cent.* or 125l. currency for 100l sterling, and seldom more than 50 *per cent.*

3 The weights and measures, in the British colonies and plantations, are the same as those in London, differing only in their kentals or hundred weight; their hundred being only 100lb. Avoirdupois, and that of London, 112lb.

Q. What foreign coins usually pass in the British colonies ıd plantations?

A. These following; the values of which were ascertained y an act of parliament made in the sixth year of Queen Anne.

	Weight		*True Val*		*Curr. Value.*		
	dwt.	*gr*	*s*	*d.*	*s.*	*d*	*f.*
ieces of eight (old plate of Seville)	17	12	4	6	6	0	0
)itto of new - - -	14	0	3	$7\frac{1}{4}$	4	9	$2\frac{2}{3}$
lexico ditto - - -	17	12	4	6	6	0	0
illar ditto - - -	17	12	4	$6\frac{3}{4}$	6	0	0
eru ditto (old plate) -	17	12	4	5	5	10	$2\frac{2}{3}$
rofs dollars - - -	18	0	4	$4\frac{3}{4}$	5	10	$1\frac{1}{3}$
)ucatoons of Flanders -	20	21	5	6	7	4	0
rench crowns or ecues -	17	12	4	6	6	0	0
rusadoes of Portugal -	11	4	2	$10\frac{1}{4}$	3	9	$2\frac{2}{3}$
hree guilder-pieces of Holland	20	7	5	$2\frac{1}{4}$	6	10	$3\frac{2}{3}$
ld rix-dollars of the Empire	18	10	4	6	6	0	0

ote, 1, Pieces of the same weight, and not of the same value, may be presumed to be occasioned by the difference of fineness.

To remedy the inconveniences, which were caused by the different rates at which pieces of the same species were current, it was ordered by proclamation, and confirmed by the aforementioned act of parliament, that after the first day of January, 1704, no Pillar, Mexico, or Seville pieces of eight, though of full weight as above, shall be received nor paid at above six shillings a-piece, and the halves, quarters, and other lesser pieces in proportion. And the said act enjoins, That if any one shall receive or pay any of the said pieces for any more than above specified, such persons shall forfeit ten pounds.

Examples.

1. A merchant in New England stands indebted to his correspondent in London, in 4960l. 17s. 6d. currency;—what sum ıust he answer for that at London aforesaid, when the currency is 300 *per cent*? *Ans.* £1653 : 12 : 6 *sterling.*

2. My correspondent in Georgia stands indebted to me for ıerchandise in the sum of 120l. 6s. $9\frac{1}{2}$d. sterling;—how ıuch is that in their currency, at 500 *per cent*?
Ans. £601 : 13 : $11\frac{1}{2}$ *currency.*

3. Trading to Jamaica, my employer there owes me 176l. s. 8d sterling;—how much is that in their currency, at *per cent*? *Ans.* £220 : 15 : 10 *currency.*

4. I have lately purchased in Ireland, effects to the value 400l. 17s. 9d. of that place; what sum must I answer for ıat at London, exchange at 10 *per cent*?
An. £364 : 8 : 10 1 *qr* $\frac{120}{264}$.

5. My correspondent at London draws upon me for 364l. . $10\frac{1}{2}$d. sterling;—what sum must I answer for that at ublin, exchange at $8\frac{1}{2}$ *per cent*? *An.* £395 : 8 : 5 $\frac{3464}{9809}$.

Case IX.

Q. What place does London exchange with for the crown or rix-dollar?

A. With Geneva in Switzerland.

Q. How do they keep their accompts in Geneva?

A. In livres, sols, and deniers.

Note, 1. 12 Deniers make 1 sol.
20 sols make 1 livre.
3 livres make 1 rix-dollar.

2. The par is that 1 rix-dollar is equal to 4s. 6d. sterling; but in exchange it goes for 50d to 60d sterling.

Examples.

1. London draws upon Geneva for 796l. 10s. 6d. sterling—what sum does that amount to in rix-dollars at 53d per dollar? *Ans.* 3606 $\frac{48}{53}$ rix-dollars.

2. A merchant in Geneva draws upon his correspondent at London for 1960 livres, exchange at 56d *per* rix-dollar—how much sterling must be paid at London to answer that bill? *Ans.* £152 : 8 : $10\frac{2}{3}$

$\frac{1960}{3}=653\frac{1}{3}$ 1 : 56 : : $653\frac{1}{3}$: 152*l.* 8*s.* $10\frac{2}{3}$d.+

A Bill of Exchange, *viz.* London on Geneva.

London, October 19, 1793, *for* 376*l.* 11*s.* 8*d sterling to be paid in rix-dollars, at 58d. sterling each, at usance.*

" At usance, pay this my only bill of exchange to Mr.
" Janson Gramonville, or order, three hundred and seventy-
" six pounds eleven shillings and eight pence sterling, in
" rix-dollars, at 58d sterling *per* rix-dollar, value received,
" and place it to the account of

To Mr. Abraham Schulhauson, merchant, in Geneva. " Your humble servant,
" Jacobus Scomberg."

What is the value of this bill in rix-dollars? *An.* 1558 $\frac{16}{58}$ rix-dollars.

Case X.

Q. What particular piece of money does London exchange with Denmark for?

A. For rix dollars; one being valued at about 4s. 6d. sterling.

Q. How do they keep their accompts in Denmark?

In marks and shillings.

Note, 1. 16 shillings make 1 mark.
6 marks make 1 rix-dollar.

2. The rix-dollar, in exchange, goes for 45d. to 58d sterling.

Examples.

1. London draws on Copenhagen in Denmark for 184l. 16s. 7d. sterling; what sum must be answered for that in rix-dollars at 50d. each. *Ans.* 887 $\frac{9}{10}$ dollars.

2. My correspondent in London stands indebted to me, according to my books, in the sum of 1000 rix-dollars,-- what sum must he answer for that at London aforesaid, when the rix-dollar, by way of exchange, is valued at $58\frac{1}{2}$d.?

An £243 : 15.

3. A merchant in London draws upon his correspondent in Copenhagen for 400l. sterling, but will give no more for a rix-dollar than 55d sterling, that being the price of exchange;-- how many rix dollars must he receive, and what is his whole loss, and the loss *per cent.* they being above par?

An. 1745 $\frac{25}{55}$ *rix-dollars The whole loss was* £7 : 5 : 3. *and the loss per cent. was* £1 : 16 : $2\frac{1}{4}$.

d. Dol. l. Dol.

As 55 : 1 : : 400 : 1745$\frac{25}{55}$

1745$\frac{1}{2}$ at 4s. 6d.=392l. 14s. 9d. at par.

400l. --- 392l. 14s. 9d.=7l. 5s. 3d. loss.

7 : 5 : 3=1l. 16s. $3\frac{1}{4}$d. loss *per cent.*
4

CASE II.

Q. What place does London exchange with for the copper dollar?

A. With Stockholm in Sweden.

Q. How do they keep their accompts in Stockholm?

A. In rix-dollars, copper dollars and runstics.

Note 1. 32 Runstics make 1 Copper-dollar.
6 Copper-dollars 1 Rix-dollar.

2. The par of the rix dollars is equal to about 6s sterling: consequently the par of the copper-dollar is equal to 1s. sterling or 20 copper-dollars make 1l sterling, though the course of exchange is sometimes to 28 or 30 copper-dollars *per* pound sterling

3 In England, sums of money are paid in the best specie, viz. guineas, by which means 1000l. or more may be put into a small bag, and conveyed away in the pocket; but in Sweden they often pay sums of money in copper, and the merchant is obliged to send wheelbarrows instead of bags to receive it.

Examples.

1. A merchant in Stockholm draws upon his correspondent in London for 1184 rix-dollars:—what sum must he answer for that in London aforesaid, when the course of exchange is at par?

An £355 : 4s.

2. Stockholm draws upon London for 1276 rix-dollars; what sum must London answer for that, exchange at 25 copper-dollars *per* pound sterling, and what is gained or lost by the drawer at Stockholm aforesaid? *An.* £306 : 4 : 9 $2\frac{2}{5}$*qrs. the bill; and the drawer loses* £76 : 11 : 2. 1 *qr.* $\frac{3}{5}$

As 25 : 1 : : 1276×6 : 306 4 9 $2\frac{2}{5}$, *the value of the bill.*

As 25 : 5 : : 7656 : 76 11 2 $1\frac{3}{5}$, *loss.*

Having given several Bills of Exchange to be reduced into sterling or foreign money; it may not be amiss to give the form how a bill book should be kept, that a merchant may know at sight what Bills he has to pay, and what to receive; and when to pay and receive them.

1. Bills payable, *i. e.* such as you have accepted.

The Drawer's name and place of residence	Date of the Bill.	The time of payment	Payable to whom or order	The Sum drawn for	Price of Exchange	For or by whom accepted, and place of abode	The sum sterling	When due	Paid, or refused acceptance
Will Sherston, of *Venice*	17 *Aug.*	3 Months	*Abraham Jennings*	Ducats B° 4000	Sterling 54¼*d.*	*William Denny, Rood Lane*	*l.* *s* *d.* 904 3 3	15 *Nov.*	Paid

2. Bills Receivable, *i. e.* such as you have in your possession.

The Drawer's name and place of residence	Date of the Bill	The time of payment	Payable to whom or order	The Sum drawn for	Price of Exchange	For or by whom accepted, and place of abode	The sum sterling.	When due	Received, or returned protested for non-acceptance or non-payment
Mich. Tassioni, Florence.	19 *Oct.*	3 months	*James Edwards*	Ecues 1876	Sterling 63*d.*		*l.* *s.* 492 10	17 *Jan.*	Protested for non-acceptance.

Case XII.

Of the Comparison of Weights and of Measures.

Examples.

1. If 112lb. at London make 99lb. at Lisbon,—how many lb. at London are equal to 1049lb. at Lisbon?
Ans. 1186*lb.* $\frac{74}{99}$.

2. If 112lb. at London make 98lb. at Roan,—how many lb. at Roan are equal to 1000 lb. at London? *Ans.* 875 *lb.*

3. If 100 ells English make 108 braces at Venice, how many ells English are equal to 1000 braces at Venice?
Ans. 925 *ells*, 4 *qrs* 2 *na.* $\frac{56}{108}$.

4. If 100 ells at London make 145 ells at Vienna,—how many ells Vienna are equal to 10 ells at London?
Ans. 14$\frac{1}{2}$ *ells.*

Note, Hence appears the reason of those rules laid down in conjoined proportion, for placing the last number in the question either on the right hand, or the left, as the nature of the question requires.

		lb. Lis.		lb Lon.			lb Lis.
Ex. 1.	As	99	:	112	:	:	1049
				lb			lb.
				112	=		99
				1049			

		lb. Lon.		lb R.			lb. Lon.
Ex. 3.	As	112	:	98	:	:	1000
		lb.		lb.			
		112	=	98			
				1000			

Of the DOUBLE RULE of THREE.

Q. BY what is the Double Rule of Three known?

A. By five terms, which are always given in the question to find a sixth.

Q. In what proportion is the sixth term to be found?

A. If the proportion is direct, the sixth term must bear such proportion to the fourth and fifth, as the third bears to the first and second: But if the proportion is inverse, then the sixth term must bear such proportion to the fourth and fifth, as the first bears to the second and third, or as the second bears to the first and third.

Note, It is to be observed here, as in the Single Rule of Three, that direct proportion is when more requires more, or less requires less, and inverse proportion is when more requires less, or less requires more.

Q. What do you observe concerning the five given Term[s?]

A That the three first Terms are a supposition; the t[wo] last are a demand.

Q How must the Numbers given in the Questions be stated[?]

A. By two single rules of three: Or otherwise thus:

1. Let the principal cause of loss or gain, interest or d[e]crease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place, a[nd] the like, be put in the second place; and the remaining o[ne] in the third place.

3. Place the other two terms under their like in the sup[]position.

4. If the blank falls under the third term, multiply th[e] first and second terms for a divisor, and the other three f[or] a dividend.

5 If the blank falls under the first or second term, multi[]ply the third and fourth terms for a divisor and the oth[er] three for a dividend; and the quotient will be the answer.

Q. How are the following questions proved?

A. Let them be varied; or else work the same Questio[n] by two single rules of three.

Examples.

1. If 7 men can reap 84 acres of wheat in 12 days—ho[w] many men can reap 100 acres in 5 days? *Ans.* 20 m[en]

2. If 7 qrs of malt are sufficient for a family of 7 perso[ns] for 4 months,—how many qrs. are enough for 46 persons [] months? *Ans.* 115 q[rs]

3. If 8 reapers have 3l 4s. for 4 days work; how muc[h] will 48 men have for 16 days work? *Ans* £76 : 16

4. If 10 bushels of oats be enough for 18 horses 20 days;— how many bushels will serve 60 horses 36 days? *Ans.* 60 bu[shels]

5 If a footman travels 240 miles in 12 days, when th[e] days are 12 hours long;—how many days may he travel 72[0] miles in, of 16 hours long? *Ans* 27 d[ays]

6. If 56 lb. of bread will be sufficient for 7 men 14 da[ys] —how much bread will serve 21 men 3 days? *Ans.* 36 [lb.]

7. If 700l. in half a year raise 14l. interest; how mu[ch] will 400l raise in 5 years? *Ans.* £[]

8. If 30s. be the hire of 8 men for 3 days;—how ma[ny] days must 20 men work for 15l? *Ans* 12 d[ays]

9. If 4 reapers have 24s. for 3 days work;—how ma[ny] men will earn 4l. 16s. in 16 days? *Ans.* 3 m[en]

10. An usurer put out 86l to receive interest for the same, d when it had continued 8 months he received for princi-l and interest 88l. 17s. 4d.—I demand at what rate *per ct. per annum* he received interest? *Ans.* 5*l per cent.*

11 What is the interest of 200l. for 3 years and $\frac{1}{4}$, at 5 *cent. per ann?* *Ans* £37 : 10s.

12. What is the interest of 400l. for a week, at 5 *per cent. annum?* *Ans.* 7*s.* 8*d* 1 *qr* $\frac{12}{52}$.

13. What is the interest of 120l. for 126 days, at 4 *per ct. per annum?* *Ans.* £ 1 : 13 : 1 : 2 *qrs.* $\frac{258}{365}$.

te. The rule for working questions in Simple interest for days, p. 67, is taken from this rule, as appears from this last example.

Of Conjoined Proportion.

Q. What is Conjoined Proportion?

A. Conjoined Proportion is when the coins, weights, or easures of several countries are compared in the same question; or it is a linking together of many proportions.

Case I.

Q. How are questions answered in this case?

A. When it is required to know how many of the first sort coin, weight, or measure mentioned in the questions, are ual to a given number of the last; then,

1. Place the numbers alternately, beginning at the left nd, and let the last number stand on the left hand.

2. Multiply the first rank continually for a dividend, and e second for a divisor.

te. See the Note in comparison of weights and measures p. 91 for the reason of this Rule.

Q How is conjoined proportion proved?

A Make as many Single Rules of Three as the nature of e question requires.

Examples.

1 If 100 lb. English make 95 lb. Flemish, and 19 lb. emish 25lb. at Bolognia;—how many lb. English are equal 50lb at Bolognia? *Ans.* 40 *lb English.*

2. If 25 lb at London be 22 lb at Nuremburgh; 88 lb. Nuremburgh 92 lb. at Hamburgh; 46 lb at Hamburgh lb. at Lyons;—how many lb. at London are equal to 98 at Lyons? *Ans.* 100 *lb.*

3. If 6 braces at Leghorn, make 3 ells English; 5 English 9 braces at Venice,—how many braces at Legh will make 45 braces at Venice? *Ans.* 50 *braces at Leg*

4. If 3 ells English make 6 braces at Leghorn, and braces at Leghorn 135 braces at Venice;—how many English are equal to 27 braces at Venice?

Ans. 15 *ells Engl*

Case II.

Q. How are questions answered in this case?

A. When it is required to know how many of the last of coin, weight, or measure, mentioned in the question, equal to a given number of the first: then,

1. Place the numbers alternately as in Case I, but let last number stand on the right hand.

2 Multiply the second rank for a dividend, and the fi for a divisor.

Examples.

1 If 10 lb. at London make 9lb. at Amsterdam; 90lb Amsterdam 112 lb. at Thoulouse;—how many lb. at Tho louse are equal to 50 lb. at London? *Ans.* 56 *lb at Thoulo*

2. If 20 braces at Leghorn be equal to 10 vares at Lisbo 40 vares at Lisbon to 80 braces at Lucca:—how many brac at Lucca are equal to 100 braces at Leghorn?

An. 100 *braces at Luc*

OF ALLIGATION.

Q. HOW many kinds of Alligation are there?

A. Two: Alligation Medial and Alligation Alterna

Of Alligation Medial.

Q. What is Alligation Medial?

A. Alligation Medial is when the quantities and price of se veral things are given to find the mean price of the mixtu compounded of those things.

Q. What is the Rule?

A. As the whole composition,
Is to its total value;
So is any part of the composition
To its mean price.

Q. How is Alligation Medial proved?

A. Find the value of the whole mixture at the mean rate; [an]d if it agrees with the total value of the several quantities [at] their respective rates, the work is right.

Examples.

1. A farmer mingled 19 bushels of wheat at 6s *per* bushel, [an]d 40 bushels of rye, at 4s. *per* bushel, and 12 bushels of [ba]rley at 3s. *per* bushel together;—I demand what a bushel [of] this mixture is worth? *Ans* 4*s.* 4*d* 1 *qr.* $\frac{41}{71}$.

2. A farmer mingled 20 bushels of oats, at 2s *per* [bu]shel, and 30 bushels of beans, at 2s *per* bushel, and 20 [bu]shels of peas, at 3s. *per* bushel together;—I demand the [wo]rth of a bushel of this mixture? *An*, 2*s.* 3*d* 1 *qr.* $\frac{5}{7}$.

3. A vintner mingled 5 gallons of Canary, at 8s. *per* [ga]llon, and 6 gallons of Malaga, 7s *per* gallon, and 4 [ga]llons of white wine, at 6s *per* gallon together;—I demand [wh]at a gallon of this mixture is worth?

An. 7*s.* 0*d* 3 *qrs,* $\frac{1}{5}$.

4. A grocer mingled 2 cwt. of sugar at 56s. *per* cwt. [an]d 1 cwt at 43s *per* cwt. and 2 cwt. at 50s *per* cwt. toge[the]r;—I demand the price of 3 cwt. of this mixture?

Ans £ 7 : 13*s.*

5. An alehouse keeper mixed 3 sorts of ale together, viz. [...] gallons at 6d *per* gallon, 16 gallons at 7d. *per* gallon, and [...] gallons at 9d *per* gallon;—I demand what 1 gallon of [thi]s mixture is worth? *An.* 7*d* 2 *qrs.* $\frac{23}{49}$.

6. A refiner having 5 lb. of silver bullion, of 8 oz. fine, [...] lb. of 7 oz. fine, and 15 lb of 6 oz. fine, would melt [...] together;—I demand what fineness 1 lb. of this mass [wi]ll be? *An.* 6 *oz.* 13 *dwts* 8 *gr fine.*

7. A mint-master hath 3 lb. weight of gold, 22 carats [fin]e, and 3 lb of 20 carats fine;—I demand what fineness [...] oz. of this mixture will bear? *An.* 21 *carats fine.*

8. An hostler mixing provender for his horses, would put [a] quantity of beans, at 5s. *per* bushel, with the like quan[tity] of oats, at 3s 6d *per* bushel;—I demand the price of [a b]ushel of this mixture? *An* 4*s* 3*d.*

9. A maltster hath several sorts of malt, viz one sort at [...] 6d another at 4s. and another 3s 6d *per* bushel, and would mix an equal quantity of each together;—I de[ma]nd the price of a bushel of this mixture? *An.* 4*s.*

10. A brewer had ſeveral ſorts of ale, viz. one ſort at 20s. *per* barrel, another at 25s. a third at 30s. and a fourth at 35s. *per* barrel, and he would mix an equal quantity of each together;—I demand the price of a barrel, and alſo of a gallon of this mixture?

An. 27*s.* 6*d. per barrel, and* 10*d.* 1 *qr.* $\frac{8}{11}$ *per gallon*

Of Alligation Alternate.

Q. What is Alligation Alternate?

A. Alligation Alternate is when the rates of ſeveral things are given to find ſuch quantities of them, as are neceſſary to make a mixture, which may bear a certain rate propounded.

Q. How are the rates or prices of the given things to be ordered?

A. 1. They muſt be placed one over the other, and the propounded price of the compoſition againſt them; thus,

Mean rate 7 $\begin{cases} 4 \text{ pri} \\ 5 \text{ of t} \\ 6 \text{ Sim} \\ 8 \text{ ples} \end{cases}$

2. Link the ſeveral rates together, in ſuch a ſort, that one greater than the mean rate may be coupled to another which is leſs.

3 Take the differences between the mean rate, and the ſeveral prices, and place them each againſt his yoke fellow. And for the reſt, obſerve the following caſes.

Case I.

Q. What do you obſerve in this firſt caſe?

A. When the prices of the ſeveral things, together with the mean rate of the mixture, are given, without any quantity, to find how much of each ingredient is required to compoſe the mixtures, take the difference between each price and the mean rate, and ſet them alternately, and they will be the quantities required.

Q. How are the operations in this and the following caſes proved?

A. They are all proved by alligation Medial.

Examples.

1. How much rye at 4s *per* buſhel, barley, at 3s. *per* buſhel and oats at 2s. *per* buſhel, will make a mixture worth 2s. *per* buſhel? *An.* 6 *buſhels of rye,* 6 *buſhels of barley,* 24 *buſhels of oats.*

2. How many raisins of the sun at 7d. *per* lb. and Malaga raisins at 4d. *per* lb. may be mixed together for 6d. *per* lb ?

Ans. 2lb. of raisins of the sun, and 1lb. of Malaga raisins.

Note, Questions in this rule do frequently admit of an infinite variety of answers, and all in whole numbers ; as in this last example, where though 2 and 1 do answer the question, yet any other two numbers will as truly do the like, as are in the same proportion.

For 2 : 1 : : { 4 : 2
6 : 3
8 : 4
16 : 8
40 : 20, &c. without end.

A. grocer would mix three sorts of sugar together, viz. one sort of 10d. another at 7d and another at 6d. *per* lb.— how much of each sort must he take, that the whole mixture may be sold at 8d. *per* lb.

	lb.		d.	lb.		d.		lb.		d.
Ans	3	*at*	10 ;	2	*at*	7 ;	*and*	2	*at*	6 *per pound.*

4. A maltster hath several sorts of malt, *viz.* one sort at 4s. *per* bushel, another at 3s. 6d. a third at 3s. and a fourth at 2s *per* bushel; and he is desirous to mix so much of each sort together that the whole may be sold at 2s 6d. *per* bushel;— I demand how much he must take of each sort ?

	Bush.		s.	B.		s. d	B.		s.		B.		s.
Ans	6	*at*	4 ;	6	*at*	3 : 6 ;	6	*at*	3,	*and*	36	*at*	2 *per. Bush.*

5 A druggist had several sorts of tea, *viz.* one sort at 12s. *per* lb. another at 11s. a third at 9s. and a fourth at 8s. *per* pound,— I demand how much of each sort he must mix together, that the whole quantity may be afforded at 10s. *per* lb.

	lb.		s. p.
1 *An*	2	*at*	12
	1	—	11
	1	—	9
	2	—	8
2 *An.*	3	*at*	12
	2	—	11
	2	—	9
	3	—	8
3 *An.*	1	*at*	12
	2	—	11
	2	—	9
	1	—	8
4 *An.*	1	*at*	12
	3	—	11
	3	—	9
	1	—	8
5 *An.*	3	*at*	12
	1	—	11
	3	—	9
	2	—	8
6 *An.*	2	*at*	12
	3	—	11
	1	—	9
	3	—	8

7. *Ans. 3lb. of each sort.*

Note, These seven answers arise from as many different ways of linking the rates of the simples together.

O 2

6. How much alloy must I mix with bullion of 10 oz. fi[ne] to abase the same to 8 oz fine ?

Ans. to every 8 oz of bullion of 10 oz. fine put 2 oz. of all[oy] and that will abase it to 8 oz fine.

Case II.

Of Alternation Partial.

Q. What do we observe in this second case ?

A. When the rates of all the things, the quantity of bu[t] one of them, and the mean rate of the whole mixture are giv[en] to find quantities of the rest, in proportion to the quan[tity] given, take the difference between each price, and th[e] mean rate, and place them alternately, as in case 1. The[n] say,

As the difference of the same name with the quantity give[n]
Is to the rest of the differences severally ;
So is the quantity given,
To the several quantities required.

Examples.

1. A man being determined to mix 10 bushels of whea[t] at 4s *per* bushel ; with rye at 3s. with barley at 2s. and wi[th] oats at 1s. *per* bushel ; I demand how much rye, barle[y] and oats, must be mixed with the 10 bushels of wheat th[at] the whole may be sold at 28d. *per* bushel ?

1 *Ans.*
B p.
2 2 of rye
5 0 of barley
12 2 of oats

2 *Ans.*
B.
40 of rye
50 of barley
20 of oats.

3 *Ans.*
B
8 of rye
10 of barley
14 of oats

4 *Ans.*
B.
10 of rye
14 of barley
14 of oats

5 *An.*
B p.
12 2 of rye
5 0 of barley
17 2 of oats

6 *An.*
B
2 of rye
14 of barley
10 of oats

7 *An.*
B.
50 of rye
70 of barley
20 of oats

2 A man being determined to mix 12 bushels of oats [at] 18d *per* bushel, with barley at 2s 6d. with rye at 3s a[nd] with wheat at 4s. *per* bushel ; I demand how much barl[ey,] rye, and wheat, must be mixed with the 12 bushels of oa[ts] that it may bear the price of 22d *per* bushel ?

An. 1 *buſhel of each ſort.*

3. A man being determined to mix 12 buſhels of oats, at d. *per* buſhel, with barley at 2s 6d. with rye at 3s. and th wheat at 4s. *per* buſhel; I demand how much barley, e, and wheat muſt be mixed with the 12 buſhels of oats, at the whole may bear the price of 2s. 9d. *per* buſhel.

An.	B. 60 of barley 60 of rye 12 of wheat	2 *An.*	B. p. 2 $1\frac{9}{15}$ of barley 2 $1\frac{9}{15}$ of rye 12 0 of wheat
An.	B. 10 of barley 10 of rye 12 of wheat	4 *An.*	B p. 72 of barley 72 of rye 12 of wheat
An.	B. 2 of barley 12 of rye 10 of wheat	6 *An.*	B. p 14 $1\frac{9}{15}$ of barley 2 $1\frac{9}{15}$ of rye 14 $1\frac{9}{15}$ of wheat

7 *An.* 12 *buſhels of each ſort.*

4. A man being determined to mix 12 buſhels of oats, at d *per* buſhel, with barley at 2s. 6d with rye at 3s. and th wheat at 4s. *per* buſhel; I demand how much barley, e, and wheat muſt be mixed with the 12 buſhels of oats, t the whole quantity may bear the price of 3s 6d. *per* ſhel?

An. B.
12 of barley
12 of rye
84 of wheat

5. A man intends to mix 28 buſhels of oats at 18d. *per* ſhel, with barley at 2s. 6d. with rye at 3s. and with wheat 4s. I would know how much barley, rye, and wheat ought be added to the 28 buſhels of oats, that the whole quan- y may be afforded at 2s. *per* buſhel?

An. 4 *buſhels of each ſort.*

6. A farmer would mix 27 buſhels of peaſe at 18d. *per* ſhel, with oats at 28d. and with beans at 30d. *per* buſhel; at the whole quantity may bear the price of 20d *per* buſhel; demand how much oats and beans muſt be mixed with the buſhels of peaſe? *An.* 3 *buſhels of each ſort.*

CASE III.

Of Alternation Total.

Q. What do you observe in this third case?

A. When the rates of the several things, the quantit be compounded, and the mean rate of the whole mixture given, to find how much of each sort will make up the qu tity: place the differences between the several prices, and mean rate, alternately, as in Case I. Then say,

As the sum of the differences,
Is to the whole composition:
So is the difference of each rate,
To the quantity of the same rate.

Examples.

1. A grocer hath four sorts of sugar, viz. at 8d. *per* lb 6d. *per* lb. at 4d. *per* lb. and at 2d. *per* lb and he would h a composition of an cwt. worth 5d. *per* lb. I demand h much of each sort he must take?

1 *An.*

lb.	d. p. lb.
42 at	8
14	6
14	4
42	2
112	

2 *An.*

lb.	d. p. lb.
14 at	8
42	6
42	4
14	2
112	

3 *An.*

lb.	oz.	dr.	d p. lb
28	0	0 at	8
37	5	$5\frac{4}{11}$	6
9	5	$5\frac{4}{11}$	4
37	5	$5\frac{4}{11}$	2
112	0	0	

4 *An.*

lb.	oz.	dr.	d.
37	5	$5\frac{4}{11}$ at	8
9	5	$5\frac{4}{11}$	6
37	5	$5\frac{4}{11}$	4
28	0	0	2
112	0	0	

5 *An.*

lb.	oz.	dr.	d p. lb.
11	3	$3\frac{2}{10}$ at	8
44	12	$12\frac{8}{10}$	6
44	12	$12\frac{8}{10}$	4
11	3	$3\frac{2}{10}$	2
112	0	0	

6 *An.*

lb.	d.
32 at	8
24	6
24	4
32	2
112	

7 *An.* 28 *lb. of each sort.*

2. A vintner hath 4 sorts of wine, *viz.* Canary at 10s. *per* gallon, Malaga at 8s. Rhenish at 6s and Oporto at 4s. and is minded to make a composition of 60 gallons, worth 9s. *per* gallon; I demand how much of each sort he must have?

Ans 45 *gallons of Canary, and* 5 *gal of each other sort.*

3. A brewer hath 3 sorts of ale, viz at 10d. at 8d. and at 6d. *per* gallon; and he would have a composition of 30 gallons, worth 7d. *per* gallon;— I demand how much of each sort he must have?

	Gals	d. per gallon.
	5	at 10
	5	— 8
Ans.	20	— 6
	—	
	30	
	—	

4. A goldsmith hath several sorts of gold, viz some of 24 carats fine, some of 22 carats, and some of 18 carats fine; and he would have compounded of these sorts the quantity of 60 oz. of 20 carats fine; — I demand how much of each sort he must take?

	Oz.	
	12	at 24 carats fine.
	12	— 22 ————
Ans.	36	— 18 ————
	—	
	60	
	—	

5. A goldsmith had gold of three sorts, viz of 22 carats, of 21 carats, and of 20 carats fine, and he would mix with these so much alloy, as that the quantity of 21 oz. may bear 18 carats fine;— I demand how much of each sort he must take, and how much alloy?

An. 6 *oz of each sort of gold, and* 3 *oz of alloy.*

6. A druggist had three sorts of drugs, one was worth 4s. *per* lb. another 5s. and another 8s. and out of these he made two parcels, one was 21lb. at 6s *per* lb. and the other 35lb. at 7s. *per* lb. how much of every sort did he take for each parcel?

	lb.	s. *per* lb.	lb.	s. *per* lb.
	6	at 4	5	at 4
	6	5	5	5
Ans.	9	8	25	8
	—		—	
	21	6s. *per* lb.	35	7s. *per* lb.
	—			

Of POSITION.

Q. WHAT is Position, or Negative Arithmetic?
A. It discovers the truth by supposed numb

Q. How many kinds of Position are there?
A. Two; Single and Double.

Of Single Position.

Q. What is Single Position?
A. It discovers the truth by only one supposed numbe

Q. How is that supposed number used?
A. By working with it, as if it was the true number, the same proportion as the question directs; and if the res be either too much or too little, the true number may found out by the following rule, viz.

As the result of the position,
Is to the position:
So is the given number,
To the number required.

Q How do you prove Position?
A. Position, both Single and Double, is proved by addi the several sums required, or the several parts of the sum r quired, together; and if that sum agrees with the given su it is right.

Examples

1 Two men, A and B, having found a bag of mone disputed who should have it; A said, the half, third and fourt of the money made 130l and if B could tell how much wa in it, he should have it all, otherwise he should have nothing I demand how much was in the bag? *Ans.* £ 120

2. A, B, and C, determining to buy together a certai quantity of timber, worth 36l agree that B shall pay $\frac{1}{3}$ mor than A, and C $\frac{1}{4}$ more than B; I demand how much eac man must pay? *Ans. A* 9l *B* 12l. *C* 15l

3. A person having about him a certainnumber of crowns said, if the half, third, and fourth of them were added to gether, they would make 65 crowns; I demand how many he had? *Ans.* 60 *crowns*

4. A lent B a sum of money, to be paid at four payments when three of them were made, and A came to demand the fourth, B would give him no more, except he would tell him how much was paid already. A said, the first payment was a fourth; the second, a fifth; and the third, a sixth of the sum first lent, and altogether made 74l. I demand the sum lent? *Ans.* £ 120

5. One man carrying a bag of money in his hand, another asked him how much was in it: He answered he could not tell; but the third, fourth, and fifth of it made 94l. How much was in the bag? *Ans.* £120.

6. I have delivered to a banker a certain sum of money, to receive of him, after the rate of 6l. *per cent. per annum*; and at the end of ten years, he paid me 500l. for principal and interest together; I demand the sum delivered to him at first? *An.* £312 : 10s.

Note, This question properly belongs to 5th case of Simple Interest.

Of Double Position.

Q. What is Double Position?

A. It is that which discovers the true number sought, by making use of two supposed numbers.

Q. How are those supposed numbers used?

A. 1. By working with them as if they were the true numbers, in the same proportion as the question directs.

2. The results or errors must be placed against their positions, or supposed numbers; thus,

Pos.	*Err.*
40	28
36	19

3. Multiply them cross-wise.

4. If the errors are alike, *i. e.* both greater, or both less than the given number, take their difference for a divisor, and the difference of the products for a dividend.

5. If the errors are unlike, take their sum for a divisor and the sum of the products for a dividend; the quotient thence arising will be the answer.

Examples.

1. A, B, and C, would divide 100l. between them, so as that B may have 3l more than A, and C 4l. more than B; I demand how much each man must have?

Ans. *A* 30*l.* *B* 33*l.* *C* 37*l.*

2. A man lying at the point of death, said, He had in a certain coffer 100l. which he bequeathed to 3 of his friends after this manner: The first must have a certain portion, the second must have twice as much as the first, wanting 8l. and the third must have three times as much as the first, wanting 15l. I demand how much each man must have?

An. *The first* 20*l* 16*s.* *Second* 33*l.* *Third* 46*l.* 10*s.*

3. A, B, and C built an house which cost 100l. of which A paid a certain sum; B paid 10l more than A; and C paid as much as A and B; I demand each man's share in that charge?

Ans. *A* 20*l.* *B* 30*l.* *C* 50*l.*

4 Three persons discoursed together concerning their ag[es]; says A, I am 20 years of age; says B, I am as old as A, a[nd] half C; and says C, I am as old as you both; I demand [the] age of each person? *An. A was 20, B 60, C 80 years of [age].*

5. A man lying at the point of death, left to his 3 sons his estate in money, viz to F half wanting 50l.; to G one th[ird] and to H the rest, which was 10l less than the share of [G]. I demand the sum left, and each man's part? *An.* [The] *sum left was 360l. whereof F had 130l. G 120l. H 1[10l.]*

6. A certain man having drove his swine to the mar[ket] viz. hogs, sows, and pigs, received for them all 50l. be[ing] paid for every hog 18s. for every sow 16s. for every pig [2s.] There were as many hogs, as sows, and for every sow th[ere] were three pigs; I demand how many there were of e[ach] sort? *An. 25 hogs, 25 sows, 75 [pigs].*

7. A surly old fellow being demanded the ages of his [four] children, answered, You may go and look: But if you m[ust] needs know, my first son was born just one year after I [was] married to his mother, who after his birth lived 5 years, [and] then died in child-bed with my second son: 4 years after [which] I married again, and within 2 years had my third and fo[urth] sons at a birth: the sum of whose two ages is now equa[l to] that of the eldest: I demand their several ages?

An. The first son was 22 years old, the second 17, the t[hird] 11, *and the fourth* 11 *years old.*

Of COMPARATIVE ARITHMETIC.

Q. WHAT is Comparative Arithmetic?

A. It is such as answers questions by num[bers] having relation one to another.

Q. Wherein does this relation consist?

A. It consists either in quantity or quality.

Q. What is relation of numbers in quantity?

A. It is the respect that one number has to another.

Q. How many are the numbers propounded?

A. They are always two, the antecedent and the conseq[uent].

Q. In what does relation of numbers in quantity co[nsist]?

A. It consists in the difference, or else in the rate or r[eason] that is found between the terms propounded.

Note. The difference of any two numbers is the remainder; but th[e rate] or reason is the quotient of the antecedent divided by the conse[quent].

Q. What is relation of numbers in quality or progression?

A. Progression or proportion is the respect that the reason of numbers have one to another.

Q. How many must the terms be?

A. Three or more, but never less: Because less than three will not admit of a comparison of reasons or differences.

Of Progression.

Q. How many kinds of Progression are there?

A. Two; Arithmetical and Geometrical.

Of Arithmetical Progression.

Q. What is Arithmetical Progression?

A. Arithmetical Progression is when several numbers have equal differences; as 1, 2, 3, 4, differ by 1; or 2, 4, 6, 8, differ by 2.

Note, 1, If any number of terms differ by Arithmetical Progression, the sum of the two extremes, will be equal to the sum of any two means, equally distant from the extremes. As in 2, 4, 6, 8, where 2 + 8 are = 4 + 6 = 10, and so of any larger number of terms.

2. If the number of terms be odd, the middlemost supplies the place of two terms. As in 1, 2, 3; where 1 + 3 are = 2 + 2 = 4.

Case I.

Q. What do you observe in this first case?

A. When the two extremes, and the number of terms in any series of numbers in Arithmetical Progression are given, and the sum of all the terms is required, then multiply the sum of the two extremes by half the number of terms: Or, multiply half the sum of the extremes by the whole number of terms, the product is the total of all the terms.

Examples.

1. How many strokes does the hammer of a clock strike in 12 hours? *Ans.* 78.

2. A merchant hath sold 100 yards of superfine cloth, viz. the first yard for 1s. the second for 2s. the third for 3s. &c. I demand how much he received for the said cloth?

Ans. £252 : 10s.

3. Bought 19 yards of shalloon, and gave 1d for the first yard, 3d. for the second, 5d for the third, &c. increasing 2d. every yard;—I demand what I gave for the 19 yards?

Ans. 1 : 10 : 1.

4. A mercer sold 20 yards of silk, at 3d. for the first yard 6d. for the second, 9d. for the third, &c increasing 3d. every yard;—I demand what he sold the 20 yards for?

Ans £2 : 12 : 6

5. A butcher bought 100 head of cattle, viz. oxen, and gave for the first ox 1 crown, for the second ox 2 crowns, for

third ox 3 crowns, &c.—I demand what the cattle co[st] him?

Ans. £1262 : 10[…]

6. Admit 100 stones were laid 2 yards distant from each other in a right line, and a basket placed 2 yards from the first stone;—I demand how many miles a man shall go in gathering them singly into the basket?

Ans 11 *miles*, 3 *furlongs*, 180 *yards*

7. A merchant sold 100 yards of linen at 2 pins for the first yard, four for the second, and 6 for the third, &c. increasing 2 pins, for every yard;—I demand how much the linen produced, when the pins were afterwards sold at 12 for a farthing? Also whether the said merchant gained or lost by the sale thereof, and how much, supposing the said linen to have been bought at 6d *per* yard?

Ans. { *The linen produced* £86 : 17 : 1[…]
{ *The merchant gained* 61 : 17 : 1[…]

Case II.

Q. What do you observe in this second case?

A. When the two extremes, and the number of terms in any series of numbers in Arithmetical Progression are given, and the common difference of all the terms in that series are required, then,

Divide the difference between the two extremes by the number of terms less one; the quotient will be the common difference.

Examples.

1. There are 21 men, whose ages are equally distant from each other in Arithmetical Progression; the youngest is 20 years old, and the eldest is 60:—I demand the common difference of their ages, and the age of each man?

Ans The common difference is two years; therefore,

Years.

60 is the age of the first man.

60 — 2 = 58 is the age of the second.

58 — 2 = 56 is the age of the third.

56 — 2 = 54 is the age of the fourth, &c.

2. A debt is to be discharged at 16 several payments in Arithmetical Proportion; the first payment is to be 14l. the last 100l. what is the whole debt, and what must each payment be? *Ans. The whole debt is* 912l. *The common difference is* £5 : 14 : 8; *therefore,*

						14l.	0s.	0d.	1st payment.
14l.	0s	0d	+5l.	14s.	8d.	=19	14	8	2d.
19	14	8	+5	14	8	=25	9	4	3d.
25	9	4	+5	14	8	=31	4	0	4th, &c.

3. A man is to travel from York to a certain place in 12 days, and go but 3 miles the first day, increasing every day's journey by an equal excess, so that the last day's journey may be 36 miles;—what will each day's journey be, and how many miles is the place he goes to distant from York?

Ans. The common difference is 3; *therefore,*

Miles.
3 is the first day's journey.
3 + 3 = 6 is the second.
6 + 3 = 9 is the third.
9 + 3 = 12 is the fourth, &c.
The whole distance is 234 miles.

4. A running footman, on a wager, is to travel from London northward, as follows: that is to say, he is to go 4 miles the first day; and 40 miles the last day; and to go the whole journey in 10 days, increasing every day's journey by an equal excess;—I demand the number of miles he travelled each day, and the length of the whole journey?

Ans. The common difference 4; *therefore,*

Miles.
4 is the first day's journey.
4 + 4 = 8 is the second.
8 + 4 = 12 is the third, &c.
The whole journey is 220 miles.

Of Geometrical Progression.

Q. What is Geometrical Progression?

A. When any rank or series of numbers increase by one common multiplier, or decrease by one common divisor, those numbers are continued in Geometrical Progression; as 3, 6, 12, 24, increase by the multiplier 2; and 24, 12, 6, 3, decrease by the divisor 2.

Note, 1, If any number of terms be continued in Geometrical Progression, the product of the two extremes will be equal to the product of any two means equally distant from the extremes, as in 3, 6, 12, 24; where 3 × 24, are = 6 × 12 = 72; and so of any larger number of terms.

2. If the number of terms be odd, the middlemost supplies the place of two terms; as in 3, 6, 12 where 3 × 12 are = 6 × 6 = 36.

3. The common multiplier, and the common divisor, are called ratios.

Q. How is the sum of any series in Geometrical Progr[ession] obtained ?

A 1. When all the terms alone are given, then from [the] product of the second and last terms, subtract the square [of] the first term : that remainder being divided by the seco[nd] term less the first will give the sum of all the terms.

2. When the two extremes and the ratio are only giv[en,] then multiply the last term into the ratio, and from that p[ro]duct subtract the first term : that remainder divide by the [ra]tio less an unit or 1, the quotient is the sum of all the ter[ms.]

Note, 1. As the last term in a long series of numbers is very tediou[s to] come at by continual multiplication ; it would be necessary for [the] readier finding it out to have a series of numbers in Arithmet[ical] Proportion, called indices, beginning with an unit, whose com[mon] difference is one : Also whatsoever number of indices you m[ake] choice of, let as many numbers (in such Geometrical Proportion [as] are given in the question) be placed under them.

Thus, { 1, 2, 3, 4, 5, 6, 7, indices,
2, 4, 8, 16, 32 64, 128, numbers in Geometrical Proport[ion.]

2. But if the first term in Geometrical Proportion be different from [the] ratio, the indices must begin with a cypher.

Thus, { 0, 1, 2, 3, 4, 5, 6, indices,
1, 2 4, 8, 16, 32, 64 numbers in Geometrical Propor[tion.]

3. When the indices begin with a cypher, the sum of the indices m[ade] choice of, must always be one less than the number of terms given in [the] question ; because 1 in the indices stands over the second term, [and] 2 in the indices stands over the third term, &c.

4. Add any two of these indices together, and that sum will dire[ctly] correspond with the product of their respective terms.

5. By the help of these indices, and a few of the first terms, in any se[ries] of Geometrical Progression, any term whose distance from the [first] term is assigned though it were never so far, may speedily be obtai[ned] without producing all the terms.

Examples.

1. A man bought a horse, and by agreement was to g[ive] a farthing for the first nail, two for the second, four for [the] third, &c there were 4 shoes, and 8 nails in each shoe :[—I] demand what the horse was worth at that rate ?

Ans. £4473924 : 5 : 3 : 3

2. A merchant sold 15 yards of satin, the first yard for [1s.] the second for 2s. the third for 4s. the fourth for 8s. &c.[—I] demand the price of the 15 yards ? *Ans.* £1638 :

3. A draper sold 20 yards of superfine cloth, the first y[ard] for 3d the second for 9d. the third for 27d. &c. in tr[iple] Proportion Geometrical ;—I demand the price of the cl[oth.]

Ans. £21792402 : 1

4. A goldsmith sold 1 lb. of gold, at a farthing for the first ounce, a penny for the second, 4d. for the third, &c. in quadruple proportion geometrical; I demand what he sold the whole for; also how much he gained by the sale; therefore supposing he gave for it 4l *per* ounce?

Ans. { He sold it for £5825 : 8 : 5 : 1 *qr.*
And gained 5777 : 8 : 5 : 1 }

5. A crafty servant agreed with a farmer (ignorant in numbers) to serve him 12 years, and to have nothing for his service but the produce of a wheat corn for the first year; and that product to be sowed for the second year; and so on from year to year, until the end of the said time; I demand his wages supposing the increase to be but in a tenfold proportion and sold out at 4s. *per* bushel? *Ans.* £452112 : 4s. *rejecting remainders.*

Note 1. 7680 wheat or barley-corns are supposed to make a pint, and 64 pints a bushel.

2. If the first term in any series, be either greater or less than the ratio, (except unity) then multiply any two terms together, and their product divide by the first term; that quotient will exactly correspond with the sum of their indices.

6. A thresher worked 20 days at a farmer's, and received for the first day's work, 4 barley-corns; for the second, 12 barley-corns; for the third, 36 barley-corns; and so on in triple proportion geometrical; I demand what the 20 days labour came to supposing the whole quantity to be sold for 2s. 6d. *per* bushel? *Ans.* £1773 : 7 : 6 *rejecting remainders.*

7. A merchant sold 30 yards of fine velvet, trimmed with gold very curiously, at 2 pins for the first yard, 6 pins for the second, 18 pins for the third, &c. in triple proportion geometrical; I demand how much the velvet produced, when the pins were afterwards sold at 100 for a farthing; also whether the said merchant gained or lost by the sale thereof, and how much, supposing the said velvet to have been bought at 5l. *per* yard?

Ans. { The velvet produced £2144699292 : 13 : 0½.
The merchant gained 2144697792 : 13 : 0½. }

OF PERMUTATION.

Q. WHAT is Permutation?

A. Changing the order of things.

Q. How do you find all the variations any number of things is capable of going through?

A. Multiply all the given terms one into another continually; the last product is the number of changes required.

Examples.

1. I demand how many changes may be rung upon twe bells; and also how long they would be ringing but o over, supposing 24 changes might be rung in one minu and the year to contain 365 days, 6 hours?

Ans. The number of changes is 479001600, *and the tim* 37 *years*, 49 *weeks*, 2 *days*, 18 *hours*.

2. Seven gentlemen, who were travelling, met togeth by chance, at a certain inn upon the road, where they w so well pleased with their host, and each others compa that, in a frolic, they offered him 30l to stay at that pl so long as they, together with him, could sit every day dinner in a different order: The host thinking that th could not sit in many different positions because they w but few of them, and that himself would make no consid able alteration, he being but one, imagined that he shou make a good bargain; and readily (for the sake of a go dinner and better company) entered into an agreement w them, and so made himself the eighth person; I dema how long they staid at the said inn, and how many differe positions they sat in? *Ans. The number of positions w* 40320; *and the time that they staid was* 110 *years*, 1 *days; allowing the year to consist of* 365 *days*, 6 *hours*.

Note, There is one thing in Progression, and in varying the order of thin which is well worth our observation; and that is, the power of nu bers, which is surprisingly great, and beyond common belief; and no ways conceivable by a common practitioner, hardly by a very go artist; it being (in appearance) not so much against reason as above The first example in geometrical progression, discovers what a pro gious sum of money a horse sold after that manner would produ viz no less than four million, four hundred and seventy-three thousa nine hundred and twenty-four pounds; whereas if the same horse h been sold at the same rate and but a fourth part of the nails would have brought to his owner no more than 5s. 3¼d. The seco example in Permutation does likewise discover the impossibility of t inn-keeper's performing his promise: and in both, the simplicity two men, who thinking they have got very good bargains, do inste thereof find themselves severe sufferers. And although, at the fi appearance, each question seems to produce but a mere trifle; yet up a mature consideration, there would not be found a man in the kin dom able to purchase the one, or long lived enough to stand to t agreement with the other. Hence observe the great possibility o man's being imposed on in this way by sharpers, without a careful e amination into the affair, before any contract is made.

THE

SCHOOLMASTER'S ASSISTANT.

PART II.

Of VULGAR FRACTIONS.

Of Fractions in general.

WHAT is a Fraction?

A. It is a broken number, and signifies the [...]or parts of a whole number.

Q. How many kinds of Fractions are there?

A. Two: Vulgar and Decimal.

Of Notation of Vulgar Fractions.

Q. What is a Vulgar Fraction?

A. Any two numbers placed thus $\frac{7}{8}$ make a Vulgar Fraction.

Q. What is the upper number of such a fraction called?

A. It is called Numerator, and is the remainder after di[...]n.

Q. What is the lower number called?

A. It is called Denominator, and denotes any whole di[...]d into parts: and is the divisor in division.

Q. How many sorts of Vulgar Fractions are there?

A. Three: Proper, improper, and compound.

Q. What is a proper Fraction?

A. When the numerator is less than the denominator, as $\frac{7}{8}$.

Q. How far may a proper Fraction be expressed?

A. Without end; as $\frac{1}{2}$ may be called $\frac{2}{4}$ or $\frac{3}{6}$ or $\frac{4}{8}$, &c. but [...]owest term $\frac{1}{2}$ is always desired.

Q. What is an improper Fraction?

A. When the numerator is greater than the denominator,

Q. What is a Compound Fraction?

A. It is the Fraction of a Fraction, as $\frac{1}{2}$ of $\frac{2}{3}$, &c.

Of Reduction of Vulgar Fractions.

CASE I.

HOW are Vulgar Fractions reduced to a common denominator?

A. 1. Multiply each numerator into all the denominators [...]own, for a new numerator.

[...]ltiply all the denominators for a common denominator.

Examples.

1. Reduce $\frac{3}{6}$ and $\frac{5}{8}$ to a common denominator.
Facit $\frac{24}{48}$ an

2. Reduce $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$, to a common denominato
Facit $\frac{840}{960}$, $\frac{864}{960}$ and

3. Reduce $\frac{6}{10}$, $\frac{4}{8}$, $\frac{1}{9}$, and $\frac{6}{7}$ to a common denominat
Facit $\frac{3024}{5040}$, $\frac{2520}{5040}$, $\frac{560}{5040}$, and

4. Reduce $\frac{4}{9}$, $\frac{7}{11}$, $\frac{6}{7}$, and $\frac{1}{2}$, to a common denominat
Facit $\frac{616}{1386}$, $\frac{882}{1386}$, $\frac{1188}{1386}$, and

5. Reduce $\frac{6}{9}$, $\frac{2}{7}$, $\frac{1}{3}$, and $\frac{7}{8}$ to a common denominator.
Facit $\frac{1008}{1512}$, $\frac{432}{1512}$, $\frac{504}{1512}$, and

6. Reduce $\frac{4}{5}$, $\frac{1}{2}$, $\frac{5}{6}$, and $\frac{2}{8}$ to a common denominato
Facit $\frac{384}{480}$, $\frac{240}{480}$, $\frac{400}{480}$, and

Case II.

Q How do you reduce a Vulgar Fraction to its lowest

A. 1 Find a common Measure by dividing the lower by the upper; and that divisor by the remainder followi nothing remains: the last divisor is the common meas

2. Divide both parts of the fraction by the common sure, and the quotients will make the fraction require

Note 1. If the common measure happens to be 1, the given fra already in its lowest terms

2. When a fraction hath cyphers at the right hand, it may be abl ed by cutting them off thus, $\frac{7|0}{9|0}$.

3. This case will prove case 1.

Examples.

1. Reduce $\frac{48}{56}$ to its lowest terms. *Faci*
2. Reduce $\frac{72}{94}$ to its lowest terms. *Faci*
3. Reduce $\frac{84}{170}$ to its lowest terms. *Faci*
4. Reduce $\frac{60}{125}$ to its lowest terms. *Faci*
5. Reduce $\frac{182}{196}$ to its lowest terms. *Faci*
6. Reduce $\frac{468}{1180}$ to its lowest terms. *Faci*

Case III.

Q. What is a mixt number?

A. It is composed of a whole number and a fraction th

Q. How is a mixt number reduced to an improper fra

A 1 Multiply the whole number into the denomina the fraction.

2 To the product add the numerator for a new num

3. Let its denominator, be the denominator given.

Note, To express a whole number fraction-wise, put 1 for its deno

Examples

Reduce $12\frac{15}{17}$ to an improper fraction. *Facit* $\frac{219}{17}$.
Reduce $19\frac{12}{18}$ to an improper fraction. *Facit* $\frac{354}{18}$.
Reduce $16\frac{18}{100}$ to an improper fraction. *Facit* $\frac{1618}{100}$.
Reduce $12\frac{19}{56}$ to an improper fraction. *Facit* $\frac{691}{56}$.
Reduce $100\frac{19}{59}$ to an improper fraction. *Facit* $\frac{5919}{59}$.
Reduce $79\frac{12}{19}$ to an improper fraction. *Facit* $\frac{1513}{19}$.

Case IV.

Q. How is an improper fraction reduced to its proper terms?
A. Divide the upper term by the lower.

Note, This case and case 3, prove each other.

Examples.

Reduce $\frac{219}{17}$ to its proper terms. *Facit* $12\frac{15}{17}$.
Reduce $\frac{141}{17}$ to its proper terms. *Facit* $8\frac{5}{17}$.
Reduce $\frac{126}{48}$ to its proper terms. *Facit* $2\frac{30}{48}$.
Reduce $\frac{971}{17}$ to its proper terms. *Facit* $56\frac{9}{17}$.
Reduce $\frac{13}{7}$ to its proper terms. *Facit* $1\frac{6}{7}$.
Reduce $\frac{24}{7}$ to its proper terms. *Facit* $3\frac{3}{7}$.

Case V.

Q. How do you reduce a compound fraction to a single one?
A. 1. Multiply all the numerators for a new numerator.
2. Multiply all the denominators for a new denominator.

Examples.

Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction. *Facit* $\frac{6}{24}$.
Reduce $\frac{7}{8}$ of $\frac{4}{6}$ of $\frac{9}{10}$ to a single fraction. *Facit* $\frac{252}{480}$.
Reduce $\frac{12}{24}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a single fraction. *Facit* $\frac{60}{108}$.
Reduce $\frac{5}{9}$ of $\frac{4}{8}$ of $\frac{3}{4}$ to a single fraction. *Facit* $\frac{60}{288}$.
Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction. *Facit* $\frac{24}{60}$.
Reduce $\frac{1}{2}$ of $\frac{8}{9}$ of $\frac{6}{7}$ to a single fraction. *Facit* $\frac{48}{126}$.

Case VI.

Q. How do you reduce the fraction of one denomination to the fraction of another, but greater, retaining the same value?

A. 1. Reduce the given fraction to a compound fraction, by comparing it with all the denominations between it, and the denomination, which you would reduce it to.
2. Reduce that compound fraction to a single one, by case 5.

Examples.

1. Reduce $\frac{5}{8}$ of a penny to the fraction of a pound Facit $\frac{5}{14}$
2. Reduce $\frac{1}{2}$ of a farthing to the fraction of a shilling. Facit
3. Reduce $\frac{8}{9}$ of an ounce Troy to the fraction of a poun Facit $\frac{8}{10}$
4. Reduce $\frac{6}{7}$ of a pound Avoirdupois to the fraction o cwt. Facit $\frac{6}{784}$ c
5. Reduce $\frac{9}{13}$ of a pint of wine to the fraction of a hhd Facit $\frac{9}{6552}$

Case VII.

Q. How do you reduce the fraction of one denominat to the fraction of another, but less, retaining the same valu

A. Multiply the given numerator, by the parts of the nominations between it, and that denomination you wo reduce the fraction to for a new numerator, and place it o the given denominator.

Note, This case and case 6, prove each other.

Examples.

1. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny Facit $\frac{1200}{1440}$=
2. Reduce $\frac{1}{96}$ of a shil. to the fraction of a farthing Facit
3. Reduce $\frac{8}{108}$ of a lb. Troy to the fraction of an oz Facit
4. Reduce $\frac{6}{781}$ of a cwt. to the fraction of a lb. Facit
5. Reduce $\frac{9}{6552}$ of a hhd. of wine to the fraction of a p Facit $\frac{9}{13}$ p

Case VIII.

Q. How do you reduce vulgar fractions from one de mination to another of the same value, having the nume tor of the required fraction given?

A. As the numerator of the given fraction,
Is to its denominator;
So is the numerator of the intended fraction,
To its denominator.

Examples.

1. Reduce $\frac{3}{4}$ to a fraction of the same value whose nu rator shall be 15. Facit $\frac{15}{20}$
2. Reduce $\frac{7}{8}$ to a fraction of the same value, whose nu rater shall be 42. Facit
3. Reduce $\frac{3}{4}$ to a fraction of the same value, whose nu rator shall be 34. Facit
4. Reduce $\frac{5}{9}$ to a fraction of the same value, whose nu rator shall be 73. Facit $\frac{73}{13}$

Note. From cases 8 and 9, there arises a new fraction which may no properly be called a mixt fraction.

Caſe IX.

Q. How do you reduce vulgar fractions from one denomination to another of the ſame value, having the denominator of the required fraction given?

A. As the denominator of the given fraction,
Is to its numerator:
So is the denominator of the intended fraction,
To its numerator.

Note, This caſe and caſe 8 prove each other.

Examples.

1. Reduce $\frac{3}{4}$ to a fraction of the ſame value, whoſe denominator ſhall be 20. *F*acit $\frac{15}{20}=\frac{3}{4}$.
2. Reduce $\frac{7}{8}$ to a fraction of the ſame value, whoſe denominator ſhall be 49. *F*acit $\frac{42}{49}\frac{7}{8}$.
3. Reduce $\frac{3}{4}$ to a fraction of the ſame value, whoſe denominator ſhall be 46. *F*acit $\frac{34}{46}\frac{1}{2}$.
4. Reduce $\frac{5}{9}$ to a fraction of the ſame value, whoſe denominator ſhall be 131 $\frac{2}{5}$. *F*acit $\frac{73}{131}\frac{2}{5}$.

Caſe X.

Q. How is a mixt fraction reduced to a ſingle one?

A. 1. When the numerator is the integral part: Then,

(1.) Multiply it by the denominator of the fractional part, and to that product add the numerator of the fractional part, for a new numerator.

(2.) Multiply the denominator of the fraction by the denominator of the fractional part of the numerator, for a new denominator,

Note. This proves caſe 9.

Examples.

1. Reduce $\frac{42}{49}\frac{7}{8}$ to a ſimple fraction. *F*acit $\frac{7}{8}$.
2. Reduce $\frac{34}{46}\frac{1}{2}$ to a ſimple fraction. *F*acit $\frac{3}{4}$.
3. Reduce $\frac{17}{43}\frac{4}{9}$ to a ſimple fraction. *F*acit $\frac{157}{387}$.

2. When the denominator is in the integral part: Then,

(1) Multiply it by the denominator of the fractional part and to that product add the numerator of the fractional part for a new denominator.

(2) Multiply the numerator of the fraction by the denominator of the fractional part, for a new numerator.

Note, This proves caſe 8,

Examples.

1. Reduce $\frac{73}{131}\frac{2}{5}$ to a ſimple fraction. *F*acit $\frac{365}{657}=\frac{5}{9}$.
2. Reduce $\frac{41}{73}\frac{1}{4}$ to a ſimple fraction. *F*acit $\frac{164}{293}$.
3. Reduce $\frac{7}{19}\frac{3}{5}$ to a ſimple fraction. *F*acit $\frac{35}{98}=\frac{5}{14}$.

Case XI.

Q. How do you find the proper quantity of a fraction in the known parts of an integer?

A. Multiply the numerator by the common parts of the integer, and divide by the denominator.

Examples

1. Reduce $\frac{2}{3}$ of a pound sterling to its proper quantity.
Facit 13*s* 4*d.*
2. Reduce $\frac{18}{43}$ of a shilling to its proper quantity. *Facit* $5\frac{1}{43}$*d.*
3. Reduce $\frac{6}{7}$ of 5l. 9s. to its proper quantity.
Facit £4 : 13 : $5\frac{1}{7}$.
4. Reduce $\frac{12}{16}$ of a lb. Troy to its proper quantity. *Facit* 9*oz.*
5. Reduce $\frac{12}{78}$ of a ton weight to its proper quantity.
Facit 3*cwt.* 8*lb* 9*oz.* 13*dr.* $\frac{42}{78}$.
6. Reduce $\frac{5}{9}$ of a lb. avoirdupois to its proper quantity.
Facit 8*oz.* 14*dr.* $\frac{2}{9}$.
7. Reduce $\frac{9}{11}$ of 10 cwt. 1 *qr* 12*lb.* to its proper quantity.
Facit 8*cwt* 1*qr.* 25*lb.* 1*oz.* 7*dr.* $\frac{3}{11}$.
8. Reduce $\frac{4}{7}$ of a mile to its proper quantity.
Facit 4*fur.* 125*yds.* 2 *feet,* 1 *in.* 2 *b.c.* $\frac{1}{7}$.
9. Reduce $\frac{9}{10}$ of a yard to its proper quantity.
Facit 2 *feet* 8 *in.* 1 *b. c.* $\frac{2}{10}$.
10. Reduce $\frac{4}{5}$ of an ell English to its proper quantity.
Facit 1 *yard.*
11. Reduce $\frac{7}{16}$ of an acre to its proper quantity.
Facit 1 *rood* 30 *perches.*
12. Reduce $\frac{4}{9}$ of a tun of wine to its proper quantity.
Facit 1 *hhd.* 49 *gal.*
13. Reduce $\frac{7}{8}$ of a barrel of beer to its proper quantity.
Facit 31 *gals* $\frac{1}{2}$.
14. Reduce $\frac{3}{8}$ of a chaldron of coals to its proper quantity.
Facit 13 *bush.* $\frac{1}{2}$.
15. Reduce $\frac{2}{7}$ of a quarter of corn to its proper quantity.
Facit 2 *bush.* 1 $\frac{1}{7}$ *peck.*
16. Reduce $\frac{7}{13}$ of a day natural to its proper quantity.
Facit 12 *hours* 55 *min.* 23 *sec.* $\frac{1}{13}$.
17. Reduce $\frac{4}{5}$ of a month to its proper quantity.
Facit 3 *weeks,* 1 *day,* 9 *hrs,* 36 *min.*
18. What is the proper quantity of $\frac{7}{8}$ of a yard of cloth?
Ans. 3 *qrs.* 2 *na.*
19. What is the proper quantity of $\frac{2}{9}$ of a *hhd.* of beer?
Ans. 12 *gal.*
20. What is the proper quantity of $\frac{3}{16}$ of a barrel of ale?
Ans. 6 *gals.*

Case XII.

Q. How do you reduce any given quantity to the fraction of any greater denomination of the same kind?

A. 1. Reduce the given quantity to the lowest term mentioned for a numerator.

2. Reduce the integral part to the same term for a denominator, and that will be the fraction required.

Note, 1. If there be a fraction given with the said quantity, let it be put to the numerator of the fraction required.

2. Cases 11 and 12 prove each other.

Examples.

1. Reduce 13s. 4d. to the fraction of a pound sterling. *Facit* $\frac{160}{240}=\frac{2}{3}$*l.*

2. Reduce $5\frac{1}{43}$, to the fraction of a shilling. *Facit* $\frac{18}{43}$*s.*

3. What part of 5l. 9s. is 4l. 13s. $5\frac{1}{7}$d? *Ans.* $\frac{1}{7}$.

4. Reduce 9 oz. Troy to the fraction of a lb. *Facit* $\frac{9}{12}=\frac{3}{4}$*lb.*

5. Reduce 3 cwt. 8 lb. 9 oz. 13 dr. $\frac{42}{78}$ to the fraction of a ton. *Facit* $\frac{12}{78}$ *ton.*

6. Reduce 8 oz. 14 dr. $\frac{2}{9}$ to the fraction of a lb. avoirdupois. *Facit* $\frac{5}{9}$ *lb.*

7. What part of 10 cwt. 1 qr. 12 lb. is 8 cwt. 1 qr. 25 lb. 1 oz. $7\frac{3}{11}$ dr.? *Ans.* $\frac{9}{11}$.

8. Reduce 4 fur. 125 yds. 2 feet, 1 in. 2 b. c. $\frac{1}{7}$ to the fraction of a mile. *Facit* $\frac{4}{7}$ *mile.*

9. Reduce 2 feet, 8 in. 1 b c. $\frac{2}{10}$ to the fraction of a yard. *Facit* $\frac{9}{10}$ *yard.*

10. Reduce 1 yard to the fraction of an ell. *Facit* $\frac{4}{5}$ *ell.*

11. Reduce 1 rood, 30 poles to the fraction of an acre. *Facit* $\frac{7}{16}$ *acre.*

12. Reduce 1 hhd. 49 gals. of wine to the fraction of a tun. *Facit* $\frac{4}{9}$ *tun.*

13. Reduce $31\frac{1}{2}$ gals. of beer to the fraction of a barrel. *Facit* $\frac{7}{8}$ *barrel.*

14. Reduce $13\frac{1}{2}$ bush. of coals to the fraction of a chaldron. *Facit* $\frac{3}{8}$ *chaldron.*

15. Reduce 2 bush. 1 peck $\frac{1}{7}$ of corn to the fraction of a quarter. *Facit* $\frac{2}{7}$ *quarter.*

16. Reduce 12 hrs. 55 min. 23 $\frac{1}{13}$ sec. to the fraction of a day natural. *Facit* $\frac{7}{13}$ *day.*

17. Reduce 3 w. 1 d. 9 hrs. 36 min. to the fraction of a month. *Facit* $\frac{4}{5}$ *month.*

18. Reduce 3 qrs. 2 na. to the fraction of a yard. *Facit* $\frac{7}{8}$ *yard.*

19 Reduce 12 gals. of beer to the fraction of a hhd.

Facit $\frac{2}{9}$ hhd

20. Reduce 6 gals. of ale to the fraction of a barrel.

Facit $\frac{3}{16}$ bar

21. Reduce 13 hrs. 30 min. to the fraction of a day

Facit $\frac{810}{1440}=\frac{9}{16}$

Of ADDITION of VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions added together?

A. 1. Reduce the given fractions to a common denominator.

2. Add all the numerators together for a new numerator; under which subscribe the common denominator.

Note, This rule is proved by Subtraction when 2 fractions only are given.

Examples.

1. Add $\frac{1}{2}$ and $\frac{7}{8}$ together — Facit $1\frac{6}{16}$
2. Add $\frac{7}{10}$ and $\frac{11}{12}$ and $\frac{4}{9}$ together — Facit $2\frac{66}{1080}$
3. Add 19 and $7\frac{1}{2}$ of $\frac{2}{3}$ together — Facit $26\frac{2}{8}$
4. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{2}{3}$ of $\frac{10}{20}$ together — Facit $1\frac{68}{960}$
5. Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of 14 together — Facit $43\frac{22}{24}$
6. Add $\frac{2}{3}$ and $17\frac{1}{2}$ together — Facit $18\frac{1}{6}$
7. Add $12\frac{1}{2}$ and $3\frac{2}{3}$ and $4\frac{3}{4}$ together — Facit $20\frac{22}{24}$
8. Add $6\frac{7}{8}$ of $\frac{9}{10}$ and $\frac{4}{7}$ of $\frac{1}{2}$ and $7\frac{1}{2}$ together — Facit $14\frac{1384}{2240}$

Note, In order to find the following Facits, the fractions given must be reduced to their proper quantities by case 11, in Reduction, and then added, as in addition of whole numbers.

9. Add $\frac{7}{8}$ of a pound to $\frac{3}{4}$ of a shilling — Facit 18*s.* 3*d.*
10. Add $\frac{3}{4}$ of a penny to $\frac{1}{9}$ of a pound. — Facit 2*s.* 3*d* 1 *qr.* $\frac{6}{9}$
11. Add $\frac{1}{2}$ of a lb. Troy to $\frac{7}{12}$ of an oz. — Facit 6 *oz.* 11 *dwt.* 16 *gr.*
12. Add $\frac{4}{7}$ of a ton to $\frac{9}{10}$ of an cwt.

    Facit 12 *cwt.* 1 *qr.* 8 *lb.* 12 *oz.* 12 *dr.* $\frac{8}{10}$
13. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong — Facit 8 *fur.* 28 *poles.*
14. Add $\frac{1}{2}$ of a yard to $\frac{2}{3}$ of a foot — Facit 2 *feet* 2 *in.*
15. Add $\frac{1}{3}$ of a day to $\frac{1}{2}$ of an hour — Facit 8 *hrs.* 30 *min.*
16. Add $\frac{4}{9}$ of a chal. to $\frac{7}{8}$ of a bush. — Facit 16 *bush.* 3 *pecks* $\frac{1}{2}$
17. Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together. — Fa. 2 *days*, 14 *hours*, $\frac{1}{2}$
18. Add $\frac{2}{3}$ of a yard, $\frac{3}{4}$ of a foot, and $\frac{7}{8}$ of a mile together.

    Facit 1540 *yds.* 2 *feet*, 9 *in.*

Of SUBTRACTION of VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions subtracted?

A. 1. Reduce the given fraction to a common denominator.

2. Subtract the lesser numerator from the greater, and place that difference over the common denominator.

3. When the lower fraction is greater than the upper, subtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

Note, This Rule is proved by Addition.

Examples.

1. From $\frac{111}{112}$ take $\frac{3}{4}$. - - - *Facit* $\frac{108}{448}$.
2. From $\frac{97}{100}$ take $\frac{3}{7}$. - - - *Facit* $\frac{379}{700}$.
3. From $96\frac{1}{3}$ take $14\frac{3}{7}$. - - *Facit* $81\frac{19}{21}$.
4. From 96 take $\frac{3}{5}$. - - - *Facit* $95\frac{2}{5}$.
5. From $\frac{1}{3}$ of 76 take $\frac{3}{4}$ of 21. - - *Facit* $9\frac{7}{12}$.
6. From $\frac{109}{110}$ take $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$. - *Facit* $\frac{1956}{2640}$.
7. From $71\frac{1}{2}$ take $\frac{17}{19}$. - - *Facit* $70\frac{23}{38}$.
8. From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19. - - *Facit* $1\frac{7}{12}$.

Note. In order to find the following Facits, the fractions given must be reduced to their proper quantities by case 11, in Reduction, and then subtracted, as in Subtraction of whole numbers.

9. From $\frac{1}{2}$ of a pound take $\frac{3}{4}$ of a shilling. *Facit* 9*s.* 3*d.*
10. From $\frac{1}{2}$ of a shilling take $\frac{3}{4}$ of a penny. *Facit* $5\frac{1}{4}$d.
11. From $\frac{3}{5}$ of an oz. take $\frac{7}{8}$ of dwt. *Facit* 11 *dwts.* 3 *gr.*
12. From $\frac{1}{2}$ of an cwt. take $\frac{7}{12}$ of a pound.
    Facit 1 *qr.* 27 *lb.* 6 *oz.* 10 *dr.* $\frac{8}{12}$.
13. From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile
    Facit 1 *mile*, 2 *furlongs*, 16 *poles*.
14. From 1 ell take $\frac{7}{10}$ of a qr. *Facit* 1 *yd.* 1 *na.* $\frac{2}{10}$.
15. From $\frac{3}{12}$ of a hhd. of beer take 1 gal. *Facit* 12 *gal.* $\frac{1}{2}$.
16. From $\frac{4}{8}$ of a chaldron take $\frac{2}{3}$ of a bushel.
    Facit 17 *bushel*, 1 *peck* $\frac{1}{3}$.
17. From 7 weeks take 9 days $\frac{7}{10}$.
    Facit 5 *weeks*, 4 *days*, 7 *hours*, 12 *min.*
18. From 4 days, 7 hours $\frac{1}{2}$, take 1 day 9 hours, $\frac{3}{18}$
    Facit 2 *days*, 22 *hours*, $\frac{1}{3}$.

OF MULTIPLICATION OF VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions multiplied?

A. 1 Prepare the given numbers (if need be) by the rules of reduction.

2. Multiply all the given numerators for a new numerator, and all the denominators for a new denominator.

Note, When any number, either whole or mixt, is multiplied by a fraction, the product is always less than the multiplicand in the same proportion, as the multiplying fraction is less than 1 or an unit.

Examples.

1. Multiply $\frac{3}{7}$ by $\frac{3}{11}$ - - *Facit* [illegible]
2. Multiply $\frac{4}{8}$ by $\frac{7}{9}$ - - *Facit* [illegible]
3. Multiply $\frac{1}{5}$ of $\frac{4}{5}$ by $\frac{7}{10}$ of $\frac{11}{12}$ - *Facit* $\frac{308}{185}$[illegible]
4. Multiply $7\frac{1}{4}$ by $8\frac{1}{2}$ - *Facit* 61[illegible]
5. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$ - - *Facit* [illegible]
6. Multiply $\frac{7}{8}$ by $13\frac{9}{10}$ - *Facit* 12[illegible]
7. Multiply $\frac{1}{2}$ of 7 by $\frac{3}{6}$ - - *Facit* 1[illegible]
8. Multiply $\frac{3}{5}$ of 8 by $\frac{7}{8}$ of 5 - - *Facit* 2[illegible]
9. Multiply $\frac{3}{6}$ by $\frac{4}{9}$ of 11 - *Facit* 2[illegible]
10. Multiply $\frac{4}{5}$ of 91 by $71\frac{1}{2}$ - *Facit* 5205[illegible]
11. Multiply $12\frac{3}{5}$ by $\frac{2}{6}$ of 7 - *Facit* 29[illegible]
12. Multiply $7\frac{1}{2}$ by $9\frac{1}{4}$ - - *Facit* 69[illegible]

Of DIVISION of VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions divided.

A. 1. Prepare the numbers given (if need be) by the rules of reduction.

2. Multiply the denominator of the divisor into the numerator of the dividend, for a new numerator; and the numerator of the divisor into the denominator of the dividend, for a new denominator.

Note 1. When the dividend is greater than the divisor, the quotient will be greater than the dividend: but when the dividend is less than the divisor, then the quotient will be less than the dividend, and in the same proportion as an unit is greater or less than the dividing fraction.

2. Multiplication and Division prove each other.

Examples.

1. Divide $\frac{17}{21}$ by $\frac{3}{5}$ - - *Facit* 1[illegible]
2. Divide $\frac{13}{19}$ by $\frac{7}{9}$ - - *Facit* [illegible]
3. Divide $\frac{14}{19}$ by $\frac{7}{10}$ - - *Facit* 1[illegible]
4. Divide $1\frac{1}{2}$ by $4\frac{8}{10}$ - *Facit* [illegible]
5. Divide $\frac{7}{8}$ by 4 - - *Facit* [illegible]
6. Divide 4 by $\frac{7}{8}$ - - - *Facit* 4[illegible]
7. Divide 99 by 108 - - *Facit* [illegible]
8. Divide $\frac{1}{3}$ of 19 by $\frac{2}{3}$ of $\frac{3}{4}$ - *Facit* 7[illegible]
9. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$ - - *Facit* [illegible]
10. Divide $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{1}{2}$ of $\frac{2}{3}$ - *Facit* 1[illegible]
11. Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4 - - *Facit* 2[illegible]
12. Divide $\frac{5}{9}$ of 4 by $4\frac{5}{9}$ - - *Facit* [illegible]

OF THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

Q. HOW is the Rule of Three in Fractions performed?

A. The operation of the Rule of Three in Fractions; both single and double, vulgar and decimal, are exactly agreeable to the principles laid down in the same rules in whole numbers.

Q. How are the following examples proved?

A. By changing the order of them.

Examples.

1. If $\frac{11}{13}$ lb. of sugar cost $\frac{7}{15}$ of a shilling, what cost $\frac{32}{43}$ lb? *Ans.* $\frac{2912}{7095}$*s.* = 4*d.* 3 *qrs.* $\frac{4971}{7095}$.

2. If $\frac{3}{5}$ ell cost $\frac{2}{3}$l.—what cost $\frac{12}{17}$ ell? *Ans.* 15*s* 8*d.* $\frac{36}{153}$.

3. If $\frac{4}{7}$ ell cost $\frac{7}{13}$l—what cost 1 ell? *Ans.* 18*s.* 10$\frac{8}{52}$*d.*

4. If 2 oz. of silver cost 16s. 5d.—what cost $\frac{3}{4}$ oz. *Ans.* 6*s.* 1*d.* 3 *qrs.* $\frac{1}{2}$.

5. If 6$\frac{1}{2}$ yards cost 18s.—what cost 9$\frac{1}{4}$ yards? *Ans.* £1 : 5 : 7 : 1 *qr.* $\frac{28}{52}$.

6. If 1 dollar be worth 56$\frac{3}{5}$d—what are 500 dollars worth? *Ans.* £117 : 18 : 4.

7. If 1$\frac{1}{4}$ yard cost 9s. what cost 16$\frac{1}{4}$ yards? *Ans.* £5 : 17

8. If 1 pistole be 17$\frac{1}{5}$s.—what are 100 pistoles? *Ans.* £86.

9. If $\frac{5}{7}$ oz. cost $\frac{11}{12}$l.—what cost 1 oz. *Ans.* £1 : 5 : 8

10. If an ingot of silver weighs 16$\frac{11}{15}$ oz.—what is it worth at 5s. 6d *per* oz? *Ans.* £4 : 12 : 0 : 1 *qr.* $\frac{9}{15}$.

11. If $\frac{9}{10}$ cwt. cost 14l. 4s.—what will 7$\frac{1}{2}$ cwt. cost? *Ans.* £118 : 6 : 8.

12. If $\frac{3}{5}$ of an ell cost $\frac{2}{3}$ of 19s.—what cost 7 ells? *Ans* £7 : 7 : 9 : 1 *qr.* $\frac{3}{9}$.

13. If 8lb. of tobacco cost 4s. 9$\frac{1}{3}$—what cost 1 lb.? *Ans.* 7$\frac{1}{3}$*d.*

14. If 1 yard of broad cloth cost 15$\frac{5}{8}$s.—what will 4 pieces, each containing 27$\frac{3}{8}$ yards cost? *Ans.* £85 : 10 : 11$\frac{1}{4}$.

15. A mercer bought 3$\frac{1}{2}$ pieces of silk, each containing 24$\frac{1}{3}$ yards, at 6s. 0$\frac{1}{2}$d. *per* yard.—I demand the value of the 3 pieces $\frac{1}{2}$ at that rate? *An.* £25 : 14 : 6 : 2 *qrs.* $\frac{4}{12}$.

16. If $\frac{1}{3}$ lb. less by $\frac{1}{6}$ cost 13$\frac{1}{5}$d. what cost 14lb less by $\frac{1}{5}$ of 1lb? *An.* £4 : 9 : 9$\frac{3}{25}$.

17. A merchant had 5$\frac{8}{9}$ cwt. of sugar, at 6$\frac{1}{4}$d. *per* lb. which he would barter for tea, at 8$\frac{1}{8}$s. *per* lb.—I demand how much tea must be given for the sugar? *An.* 43*lb.* $\frac{6}{414}$.

18. Bought 120lb. of tea, at 8$\frac{5}{8}$s *per* lb. and sold it for 70l.—what was the gain *per cent*? *An.* £35 : 5 : 3 : 3 *qrs.* $\frac{75}{1031}$.

OF THE SINGLE RULE OF THREE I[N]VERSE IN VULGAR FRACTIONS.

1. IF $3\frac{1}{4}$ yards of cloth that is $1\frac{1}{5}$ yard wide, be ſufficie to make a cloak;—how much muſt I have of th ſort which is $\frac{4}{5}$ of a yard wide, to make a cloak of the ſa bigneſs? *Anſ* $4\frac{7}{8}$ *yar*

2. If 16 men finiſh a piece of work in $28\frac{1}{3}$ days, how lo will 12 men require to do the ſame work? *Anſ.* $37\frac{28}{36}$ *da*

3 If $1\frac{1}{4}$ yard in breadth require $20\frac{1}{2}$ yards long to ma a garment; what length will $\frac{3}{4}$ of a yard wide require make the ſame? *Anſ.* $34\frac{4}{24}$ *yar*

4. How many pieces of merchandize at $20\frac{1}{8}$s *per* piece a to be given for $240\frac{1}{7}$ pieces, at $12\frac{1}{2}$s. *per* piece? *Anſ.* $149\frac{354}{2234}$ *piec*

5. How many yards of canvas that is $1\frac{1}{4}$ yard wide w be ſufficient to line 20 yards of Say that is $\frac{3}{4}$ of a yard wid *Anſ.* 12 *yards of canva*

OF THE DOUBLE RULE OF THREE I[N] VULGAR FRACTIONS.

1. IF 9 ſtudents ſpend $10\frac{7}{9}$l. in 18 days, how much will ſtudents ſpend in 30 days? *Anſ.* £39 : 18 : 4 $\frac{36}{745}$

2. Three men having worked $19\frac{1}{2}$. days, received $8\frac{9}{10}$ — how much muſt 20 men have for $100\frac{1}{4}$ days? *Anſ* £305 : 0 : 8. $\frac{9}{40}$

3. A man and his wife having laboured 1 day, earn $4\frac{5}{8}$s.—I demand how much they muſt have for $10\frac{1}{2}$ day when their two ſons helped them? *Anſ* £4 : 17 : 1

4. A man with his family, which in all were 5 perſons, d uſually drink $7\frac{4}{5}$ gallons of beer in a week; —how much w be drank in $22\frac{1}{2}$ weeks, when three perſons more come in the family? *Anſ.* $280\frac{40}{50}$ *gallon*

5. Seven men with their wives, upon examining into the expences for 20 weeks paſt, found that they had laid o $40\frac{4}{5}$l.—I demand in what time $20\frac{3}{7}$l may be ſpent by men in the like proportion? *Anſ* 3 *weeks* $\frac{3113}{6568}$

6 Three ſailors having been abroad $9\frac{1}{4}$ months, receiv $40\frac{3}{15}$l —I demand how much 100 ſailors muſt receive f $28\frac{3}{7}$ months ſervice? *Anſ.* £4118 : 6 : 0 1 *qr.* $\frac{130}{1166}$

THE

SCHOOLMASTER'S ASSISTANT.

PART III.

OF DECIMAL FRACTIONS.

Q. WHAT do you understand by Decimals in general?

A. Any thing which is called ONE; as one foot, ne pound, one shilling, one year, &c. is conceived in imagi-ation to be divided into ten equal parts, and every one of ose parts into ten other equal parts, and so on, by a deci-al division without end.

Q. What is a Decimal Fraction?

A. Any number having a point placed before it, thus, .641, a Decimal?

Q. How do you distinguish a whole number from a Deci-al Fraction?

A. Any number having a point placed after it, thus, 641. a whole number.

Q. What is a mixt number?

A. Any quantity of figures having a point placed some-here between them, thus, 6.41, or, thus, 64.1, is a mixt umber.

Note. The decimal points must never be omitted; because without it a decimal cannot be distinguished from a whole or mixt number. But when a whole number alone is given, it is as common to omit it as to insert it; as appears by several examples following.

OF NOTATION OF DECIMALS.

Q. HOW do Decimal Places increase?

A. In the same manner as whole numbers do; hat is, by tens: For every place towards the left hand is en times greater than that which is next it towards the right and, as appears by the following table:

C Thousands.	X Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth Parts.	Hundred Parts.	Thous. Parts.	X Thous. Parts.	C Thous. Parts.
6	5	4	3	2	1	.2	3	4	5	6

Q. May not cyphers sometimes be annexed to decimals?
A. They may, but they alter not their value: Thus, .4 and .4100 are the same.
Q. May not cyphers sometimes be prefixed to decimal parts?
A. Yes; and then they decrease their value, by removing them farther from the point: Thus, .0041 is less than .4

OF ADDITION AND SUBTRACTION OF DECIMALS.

Q. HOW are Decimals added or subtracted?
A. Place the numbers according to their value, and work as in addition or subtraction of whole numbers.
Q. How are the operations proved?
A. As in whole numbers.

Examples in Addition.

Shillings.	*Yds.*	*Gallons.*	£
14.471	47.4	7004.16	71.0
1.191	19.71	712.712	120.07
1.8126	371.721	19.0174	31.12
3.6126	400.004	7.3126	14.41
7.1281	7.1004	71.1851	76.04
18.8126	7.07	3.108	7.3

Miles.	*lb.*	*Acres.*	*Ounces.*
41.8102	86.18104	.61271	48.9
140.037	3.13	.8712	1.8
18.10	1.14	.012	3.1
7.8141	7.7121	.87	.7
16.4612	8.19817	.04	.0
117.81	14.071	.6	.1

Examples in Subtraction.

	Years.	*Days.*	*Weeks.*	*Ho*
From	1081.761	712.10009	127.19	
Take	10.00012	7.121	121.	
Rem.				

	Minutes.	*Months.*	*Ells.*	*Tuns.*
From	174.1	6100.	.172618	761.8
Take	1.471	6.100	.000148	18.9
Rem.				

Of MULTIPLICATION of DECIMALS.

HOW are decimals multiplied?

A. As whole numbers are.

Note 1. When numbers are multiplied, make as many decimal parts in the product, as there are in the two factors taken together.

If decimal places are wanted in the product, supply them with cyphers to the decimal point.

Observe the same note here, which is given in Multiplication of Vulgar Fractions

Q. How are the following examples proved?

A. By inverting the factors.

Multiply .612 by 4.12		8. Multiply .00041 by .00017	
Multiply 48. by .48		9. Multiply .0027 by 41.	
Multiply 37.9 by 46.5		10. Multiply 410. by .10012	
Multiply .121 by 17.2		11. Multiply .07 by .07	
Multiply 1.81 by 71.		12. Multiply 1.007 by .041	
Multiply 4.1 by 1.42		13. Multiply 4 001 by .004	
Multiply .00071 by .121		14. Multiply .004 by .004	

Of DIVISION of DECIMALS.

HOW are Decimals divided?

A. As whole Numbers are.

Note 1. The decimal places of the divisor and quotient must always be equal to those in the dividend.

If there be more decimals in the divisor than in the dividend, annex as many cyphers as you please to the dividend, so as to be equal at least to the divisor.

If decimal places are wanting in the quotient, they must be supplied with cyphers to the decimal point.

Observe the same note here, which is given in Division of Vulgar Fractions.

Q. How are the following examples to be proved.

A. By Multiplication.

Examples.

Divide 19.4 by 37.5	7. Divide 9. by .7121
Divide 47121.1 by 47.	8. Divide 9. by .9
Divide 4.18 by .1812	9. Divide 14. by 47.31
Divide .76121 by 41.	10. Divide 1. by .863
Divide .612821 by 7.21	11. Divide 012181 by .12
Divide .12181 by .721	12. Divide .8001212 by .018

OF REDUCTION OF DECIMALS.

CASE I.

Q. HOW do you reduce a vulgar Fraction to a Decim[al]
A. Divide the upper term by the lower.

Note, 1. Both terms are to be esteemed whole numbers.
2 By this case, tables containing the Decimal parts of an integer [are] constructed.

Examples.

1. Reduce $\frac{5}{26}$ to a decimal. - *Facit* .1923076
2. Reduce $\frac{5}{28}$ to a decimal. - *Facit* .1785714
3. Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a decimal. *Facit* .6043956
4. Reduce 7s 6d. to the decimal of a pound. *Facit* .37[5]
5. Reduce 10s. 9¼d. to the decimal of a pound *Facit* .5385416+
6. Reduce 24 grains to the decimal of a lb. Troy. *Facit* .0041666+
7. Reduce 14 drams to the decimal of a lb. Avoirdupois. *Facit* .0546875
8. Reduce 4 cwt. 2 qrs. to the decimal of a ton. *Facit* .225 *to[n]*
9. Reduce 14 cwt. to the decimal of a ton. *Facit* .7 *to[n]*
10. Reduce 174 drams to the decimal of an cwt *Facit* .0060686+*cw[t]*
11. Reduce 4 inches to the decimal of a yard *Facit* .1111111+*yar[d]*
12. Reduce 76 yards to the decimal of a mile. *Facit* .04318181+*mil[e]*
13. Reduce 1 mile to the decimal of a league. *Facit* .33333333+*leagu[e]*
14. Reduce 3 qrs. 2 na. to the decimal of a yard. *Facit* .875 *yar[d]*
15. Reduce 4 perches to the decimal of an acre. *Facit* .025 *acr[e]*
16. Reduce 1 pint to the decimal of a gallon *Facit* .125 *ga[l]*
17. Reduce 1 gallon of wine to the decimal of a hhd. *Facit* .015873+*hh[d]*
18. Reduce 7 minutes to the decimal of a day. *Facit* .0048611+ *da[y]*
19. Reduce 2 days to the decimal of a week. *Facit* .2857142 + *wee[k]*
20. Reduce 72 days to the decimal of a year. *Facit* .1972602 + *year*

Case II.

Q. How do you find the proper quantity of a Decima[l] Fraction in the known parts of an Integer?

A. Multiply it by the common parts of the integer?

Q. How do you prove questions in this case?

A. By Case I.

Examples.

1. What is the proper quantity of .76 of a pound?
Ans 15*s.* 2*d.* 1.6 *qr.*
2. What is the proper quantity of .861 of a cwt.?
Ans. 3 *qrs.* 12*lb* 6 *oz* 14.592 *dr.*
3. What is the proper quantity of .461 of a shilling?
An. 5*d.* 2.128 *qrs.*
4. What is the proper quantity of .761 of a hhd. of wine
An. 47 *gals.* 3 *qrs.* 1.544 *pt.*
5. What is the proper quantity of .17 of a tun of wine?
An 42 *gals* 3.36 *qts.*
6. What is the proper quantity of .761 of a day?
Ans. 18 *hrs.* 15 *min* 50.4 *sec.*
7. What is the proper quantity of .7 of a lb. of silver?
An 8 *oz* 8 *dwts.*
8. What is the proper quantity or .71 of 4 oz. of gold?
An. 2 *oz* 16 *dwts.* 19.2 *gr.*
9. What is the proper quantity of .67 of a league?
An 2 *miles*, 0 *fur.* 3 *poles*, 1 *yd.* 0 *feet*, 3 *in* 18 *b. c.*
10. What is the proper quantity of .712 of a furlong?
An. 28 *poles*, 2 *yds.* 1 *foot*, 11.04 *in.*
11. What is the proper quantity of .07 of a barrel of ale?
Ans. 2 *gals.* 1.92 *pt.*
12. What is the proper quantity of .4712 of an ell English?
An. 2 *qrs.* 1.424 *na.*
13. What is the proper quantity of .72 of a hhd. of beer?
Ans. 38 *gals.* 3.52 *qts.*
14. What is the proper quantity of .61 of a ton of wine?
An 2 *hhds.* 27 *gals.* 2 *qts* 1.76 *pt.*
15. What is the proper quantity of .092 of 3 acres, 2 roods?
An. 1 *rood*, 11.52 *poles.*
16. What is the proper quantity of .461 of a chaldron of coals?
An 16 *bush* 2.384 *pecks.*
17. What is the proper quantity of .712 of 3 qrs. of corn?
An. 17 *bush.* 2.816 *qrs.*
18. What is the proper quantity of .3 of a year?
An. 109 *days*, 12 *hrs.*
19. What is the proper quantity of .5 of an hour? *An.* 30 *m.*
20. A certain tenant hired an house for 9 years at 12.4l. *per annum*;—how much was due at the end of the term?
An. £111.12*s.*

Note 1. To this case is referred Case IV. in practice, p. 65.

Example.

	1286 at 4s.	
1st.	4s.	= .2l.
2d	1286	
	2	
	257.2	
	20	
	4.0	

Facit £257:

2. Addition and Subtraction of Decimals of different Denominatio[ns] may easily be performed, after the Decimals are reduced to their prop[er] quantities.

Examples

1. What is the sum of 48l. and .16s. reduced to their pr[o]per quantities? *Ans.* 9*s.* 9.1

2. What is the sum of .17lb. Troy, and .84 oz? *Ans* 2 *oz.* 17 *dwts.* 14.4

3. What is the sum of .17 ton, .19 cwt. .17 qr. and .7l *Ans.* 3 *cwt.* 2 *qrs.* 15.54

4. What is the difference between .17l. and .7s.? *An* 2*s.* 8*d.* 1.6

5 What is the difference between 41 days, and .16 hou[rs] *Ans.* 9 *hrs.* 40 *min.* 48

OF THE SINGLE RULE OF THREE DIREC[T] IN DECIMALS.

Q. HOW do you prove the following questions?

A. By changing their order.

Examples.

1. If 1.4lb. of mace cost 14.5s —what cost 75.31lb.? *An.* 38 : 19 : 11 : 3.52

2. If 1.6 cwt of sugar cost 3l. 12.76s.—what cost 3 hh[ds] each 11 cwt 3 qrs 10 12lb.? *An.* £80 : 15 : 3 : 3.36

3. If 5 oz. of silver be worth 7.8s.—what is the valu[e of] 9.7lb? *An.* 30*l.* 5*s* 3*d.* 1.44

4 If 1.37 cwt of sugar be worth 4.5l.—what is 1.7 worth at that rate? *An.* 1

5 If 1 pint of wine cost 1.2s.—what cost 12.5 hhds.? *An.* £3

6 If 8 4 lb of tobacco cost 16s 4.6d.—what cost 3 h[hds] each 4 cwt 2 qrs. 7.4 lb? *An.* £149 : 12 : 3 : 2

7 If 1 yard of cloth cost 12.3s.—what cost 2 pieces, e[ach] 21.5 yards? *An.* £39 : 13 :

8. A man bought a piece of cloth for 6l. 13.12s.—I demand how many yards there were in the same when he gave after the rate of 4s. 2.6d. *per* yard? *An* 31.569 *yards.*

9. A man bought 5.8 tuns of oil for 60.4l. but by misfortune it chanced to leak out 50.9 gallons;—I demand how he must sell the rest per gallon to be no loser?

Ans. 10.27*d.* *per gallon.*

10. Two men bartered, A had 40.7 yards of linen, for which B gave him 25.6 ells of holland, at 4.5s per ell;—I demand the price of the linen per yard? *An.* 2*s.* 9*d.* 3.8 *qr*

11. A grocer bought 7.6 cwt of sugar, at 40.1s. *per cent.* and sold the same out at 4.5d. per lb.—I demand whether he gained or lost, and how much? *An.* 14*s.* 5*d* 1.12 *qr. gain.*

12. A brewer made a quantity of beer, which cost him 0.4l. and afterwards sold it out at 26.7s per barrel, by which he gained 10l.—I demand the quantity that was brewed? *An.* 75 *bar.* 7.4+ *gals.*

13. A grocer bought 3 cwt. 1.5 qr. of cloves, at the rate of 2.75s. per lb and sold them for 60l 1s. 6d what did he gain or lose by the bargain? *An. He gained* £8 : 12s.

14. A merchant bought 436 yards of cloth for 8.5s per yard, and sold it again for 10.75s. *per* yard,—what did he gain by the sale thereof? *An* £49 : 1*s. gain.*

15. A owes B 296.85l but he compounds for 7.5s in the pound;—what must B receive for his debt?

An. £111 : 6 : 4 : 2 *qrs.*

16. Bought 3 hhds. of tobacco, each weighing 4 cwt. 1.9 *qr.* at 5.6l *per* cwt. which I sold out at 7l 16s. *per* cwt.—what did I gain by the whole? *Ans* £29 : 10 : 8 : 1.6 *qr.*

17. A jeweller bought a diamond for 60 guineas, and after it was neatly cut, weighed 1.5 oz. which he sold again for 2.25s. *per* grain;—I demand how much he gained by the said diamond; and also at what rate *per cent.* he made his gain?

Ans. { *Whole gain* £54 : 0 : 0 : 0 *qr.*
{ *Gain per cent.* 85 : 14 : 3 : 1.7+

Of the SQUARE ROOT.

Q. WHAT is a square?

A. Any number multiplied by itself produce[s a] square?

Q. What is the Extraction of the Square Root?

A. If a Square be given to find one side, it is called [the] Extraction of the Square Root.

Q. How is the given square to be prepared for Extracti[on?]

A. By pointing off at every two figures, from the un[it] place both ways, for a resolvend.

Q. What is a Surd?

A. It is an imperfect Square, or such a number, wh[ose] Square Root can never be exactly found.

Examples.

1. What is the square of 17.1? *Ans.* 292
2. What is the square of .09? *Ans.* .00
3. What is the square of .0094? *Ans* .00008
4. What is the square root of 4712.81261? *Ans* 68.64
5. What is the square-root of 9712.718051? *Ans.* .18 55
6. What is the square root of 3.1721812? *Ans.* 1.7810
7. What is the square-root of 1.3976121? *Ans.* 1.182
8. What is the square root of 761.801216? *Ans* 27.600
9. What is the square-root of .00076128 16? *Ans.* 0275
10. What is the square-root of 4.000067121? *Ans.* 2.00001

11 There is an army consisting of a certain numb[er of] men, who are placed rank and file, that is, in the form [of a] square, each side having 472 men;—I demand how m[any] men the whole square contains? *Ans.* 222784

12. The floor of a certain great room is made ex[actly] square, each side of which contains 75 feet;—I demand [how] many square feet are contained therein? *Ans.* 5625

13. Suppose 12544 soldiers are to be put into rank [and] file, in the form of an equal square;—I demand how m[any] soldiers will be in the front, and how many deep? *Ans.*

14. A certain square pavement contains 197136 sq[uare] stones all of the same size;—I demand how many are [con]tained in one of its sides? *Ans.*

O F C O N V E R

E X T R A C T I N G T H E

(A TABLE

Roots, or 1ſt powers - -	1	2	3	4	
Squares, or 2nd powers -	1	4	9	16	
Cubes, or 3d. power - -	1	8	27	64	
Biquadrates, or 4th powers	1	16	81	256	
Surſolids, or 5th powers -	1	32	243	1024	
Square cubes, or 6th powers -	1	64	729	4096	
Second ſurſolids, or 7th powers	1	128	2187	16384	
Biquadrates ſquared, or 8th pr.	1	256	6561	65536	
Cubes cubed, or 9th powers	1	512	19683	262144	
Surſolids ſquared or 10th powers	1	1024	59049	1048576	
Third ſurſolids, or 11th powers	1	2048	177147	4194304	4
Square-cubes ſquared, or 12th pr	1	4096	531441	16777216	24
Fourth ſurſolids, or 13th powers	1	8192	1594323	67108864	122
2nd ſurſolids ſquared, or 14th pr.	1	16384	4782969	268435456	610
Surſolids cubed, or 15th powers	1	32768	14348907	1073741824	305

ERGING SERIES;

OR

IE ROOTS OF ALL POWERS.

ABLE OF POWERS.)

4	5	6	7	8	9
6	25	36	49	64	81
4	125	216	343	512	729
6	625	1296	2401	4096	6561
4	3125	7776	16807	32768	59049
6	15625	46656	117649	262144	531441
4	78125	279936	823543	2097152	4782969
6	390625	1679616	5764801	16777216	43046721
4	1953125	10077696	40353607	134217728	387420489
6	9765625	60466176	282475249	1073741824	3486784401
4	48828125	362797056	1977326743	8589934592	31381059609
6	244140625	2176782336	13841287201	68719476736	282429536481
4	1220703125	13060694016	96889010407	549755813888	2541865828329
6	6103515625	78364164096	678223072849	4398046511104	22876792454961
4	30517578125	470184984576	4747561509943	35184372088832	205891132094649

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15. The wall of a town is 17 feet high, which is surrounded by a moat of 20 feet in breadth; I demand the length of a ladder which shall reach from the outside of the moat to the top of the wall? *Anf.* 26.2 + *Feet.*

Of the Square-Root of a Vulgar Fraction.

Q. How is the Square Root of a Vulgar Fraction extracted?

A. 1. Reduce the Fraction to its loweft terms.

2. Extract the fquare-root of the numerator for a new numerator, and the fquare root of the denominator for a new denominator.

3. If the fraction be a furd, reduce it to a decimal, and then extract the fquare root from it.

4. The decimal fractions muft confift of an even number of places, as two, four, &c.

Examples.

1. What is the fquare-root of $\frac{3044}{6849}$? *Anf.* $\frac{2}{3}$.
2. What is the fquare-root of $\frac{3456}{5400}$? *Anf.* $\frac{4}{5}$.
3. What is the fquare root of $\frac{7056}{9216}$? *Anf* $\frac{7}{8}$.

Surds.

4. What is the fquare-root of $\frac{3168}{6192}$? *An.* .71528 +
5. What is the fquare-root of $\frac{208}{272}$? *An* .87447 +
6. What is the fquare-root of $\frac{387}{738}$? *An.* 72414 +

Of the Square Root of a mixt Number.

Q. How is the Square-root of a mixt number extracted?

A. 1. Reduce the fractional part of the mixt number to its loweft term.

2. Reduce the mixt number to an improper fraction.

3. Extract the roots of the numerator and denominator, for a new numerator and denominator.

4. If the mixt number given be a furd, reduce the fractional part to a decimal and annex it to the whole number, and extract the fquare-root from the whole.

Examples.

1. What is the fquare root of 37 $\frac{36}{39}$? *An.* 6$\frac{1}{7}$
2. What is the fquare-root of 17 $\frac{16}{25}$? *An.* 4$\frac{1}{5}$
3. What is the fquare root of 5 $\frac{288}{648}$? *An.* 2$\frac{1}{3}$

Surds

4. What is the fquare-root of 76 $\frac{14}{17}$? *An.* 8.7649 +
5. What is the fquare-root of 78 $\frac{9}{21}$? *An.* 2.7961 +

Of the CUBE-ROOT.

Q. WHAT is a Cube?

A. Any number multiplied by its square produces a Cube.

Q. What is the Extraction of the Cube Root?

A. If a cube be given to find out a number which being multiplied into its square produceth the number given; this is called the Extraction of the Cube-Root.

Q. How is the given cube to be prepared for Extraction?

A. By pointing off at every three figures both ways, from the unit's place, for a Resolvend.

Q. What is a Surd?

A. It is an imperfect Cube, or such a number, whose Cube-Root can never be exactly found.

Q. What is the rule for extracting the Cube-Root of a number?

A. This: The first figure sought is the Root of the greatest cube contained in the first member, and it is called a; then $3aa+3a$ is the divisor which finds a new figure called e; then $3aae+3eea+eee$ is the subtrahend or number to be subducted; which operation is to be continued to every resolvend.

Note, This rule being somewhat dark, I shall, by way of illustration subjoin the Operation at large, for extracting the Cube-Root of any number.

Q. What is the Cube Root of 444194.947?

A. (1) Let the given number be pointed as before directed

thus 444194.947.

(2.) The first member, which contains the greatest Cube is 444; and the nearest root, whose cube is not greater than it, is 7; which set

thus 444194.947(7

(3) The cube of 7 is 343; which set down and subtract annexing the next three figures or members, viz. 194, for resolvend;

thus 444194.947(7
343

101194 Resolvend.

(4.) The number 7, in the root is called *a*; then by the rule $3aa+3a$ is the divisor; thus,

$7 = a$
$7 = a$
$49 = aa$ 444194.947(7
3 343
$147 = 3aa$ 1491)101194 Resolvend
$21 = 3a$
Divisor $1491 = 3aa+3a$

(5.) The next figure in the root, viz. 6 (found by common division is called *e*; then by the rule $3aae+3eea+eee$, is the subtrahend, or number to be subtracted: thus,

$147 = 3aa$ $6 = e$
$6 = e$ eee viz. $6 = 216$ $6 = e$
$882 = 3aae$ $36 = ee$
$756 = 3eea$ 3
216 eee $108 = 3ee$
Sub. $95976 = 3aae+3eea+eee$ $7 = a$
$756 = 3eea$

444194.947(76
343
1491)101194 Resolvend
95976 Subtrahend
5218.947 Resolvend.

(6.) When the next member is brought down, viz. 947 as before, both figures in the root, viz. 76 must be called a; then to find a divisor to this last resolvend, say as before, $3aa+3a$; thus,

$76 = a$ $76 = a$
$76 = a$ 3
456 $228 = 3a$ 444194.947(76
532 343
$5776 = aa$ 1491(101194 Resolvend
3 95976 Subtrahend
$17328 =$ 3aa173508)5218.947 Resolvend
$228 = 3a$
Divisor $173508 = 3aa+3a$

(7.) The next figure in the root, viz 3, found as before, is also called *e*; then again $3aae+3eea+eee$ is the other subtrahend, or number to be subducted; thus,

```
 17328 = 3aa                               3 = e
     3 = e        eee viz. 3 = 27          3 = e
 -----                                    ------
 51984 = 3aae                              9 = ee
  2052 = 3eea                              3
    27 = eee                              ------
 -------                                  27 = 3ee
Sub. 5218947 = 3aae + 3eea + eee          76 = a
                                          ------
                                         162
                                         189
                                         ------
                                        2052 = 3eea
```

```
          .   .   .
        444194.947(76 3 Answer
        343
  1491)101194 Resolvend
        95976 Subtrahend
173508)5218.947 Resolvend
       5218.947 Subtrahend
              0
```

Examples.

1. What is the cube of 64? *Ans.* 262.144
2. What is the cube of .13? *Ans.* 002197
3. What is the cube of 41.1? *Ans.* 69426.531
4. What is the cube of .09? *Ans.* .000729
5. What is the cube of .007? *Ans.* .000000343
6. What is the cube-root of 7612.812161? *Ans.* 19.67+
7. What is the cube-root of 76121.7612? *Ans* 195.71+
8. What is the cube-root of 61218.00121? *Ans.* 364+
9. What is the cube-root of 7121.1021698? *Ans.* 19.238+
10. What is the cube-root of 12000 812161? *Ans.* 22.89+
11. What is the cube-root of .121861281? *Ans.* .495+
12. What is the cube-root of .006976121 8? *Ans.* .19107+

13. If a cubical piece of timber be 41 inches long, 41 inches broad, and 41 inches deep, how many cubical inches doth it contain? *Ans.* 68921 *cubical inches.*

14. Suppose a cellar to be dug that shall be 12 feet every way, in length, breadth, and depth?—how many solid feet of earth must be taken out to complete the same? *An.* 1728 *feet*

15. Suppose a stone of a cubic form to contain 474552 solid inches;— what is the superficial content of one of its sides? *An.* 6084 *inches.*

Of the Cube-Root of a Vulgar Fraction.

Q. How do you extract the Cube Root of a Vulgar Fraction?

A 1. Reduce the Fraction to its lowest terms.

2. Extract the cube-roots of the numerator and denominator for a new numerator and denominator.

3. If the Fraction be a surd, reduce it to a decimal, and then extract the cube root from it.

4. The decimal fraction must consist of ternaries of places; as three, six, nine, &c.

Examples.

1. What is the cube-root of $\frac{352}{1188}$? *An.* $\frac{2}{3}$.
2. What is the cube-root of $\frac{1944}{4608}$? *Ans.* $\frac{3}{4}$.
3. What is the cube-root of $\frac{648}{3000}$? *Ans.* $\frac{3}{5}$.

SURDS.

4. What is the cube root of $\frac{4}{9}$? *An.* .763+
5. What is the cube root of $\frac{6}{7}$? *An.* .949+
6. What is the cube root of $\frac{1}{3}$? *An.* .693+

Of the Cube-Root of a Mixt Number.

Q. How do you extract the cube root of a mixt Number?

A 1. Reduce the fractional part to its lowest terms.

2. Reduce the mixt number to an improper fraction.

3. Extract the cube-roots of the numerator and denominator, for a new numerator and denominator.

4 If the mixt number given be a surd, reduce the fraction-part to a decimal, and annex it to the whole number, and extract the cube-root from the whole.

Examples.

1. What is the cube root of 578 $\frac{19}{27}$? *An.* $8\frac{1}{3}$.
2. What is the cube root of 42 $\frac{21}{24}$? *An.* $3\frac{1}{2}$.
3. What is the cube root of $5\frac{104}{125}$? *An.* $1\frac{4}{5}$.

SURDS.

4. What is the cube-root of 8 $\frac{2}{27}$? *An.* 2.013+
5. What is the cube-root of 7 $\frac{3}{5}$? *An.* 1.966+

Of the BIQUADRATE ROOT.

Q. WHAT is a Biquadrate Number?

A. Any number involved four times produce a biquadrate.

Q. How is the biquadrate-root extracted?

A. Firſt extract the ſquare-root of the given reſolvend an then extract the Square-root of that ſquare-root, for the bi quadrate-root required.

Examples.

1. What is the biquadrate-root of 48? *An.* 530841
2. What is the biquadrate root of 96? *An.* 849346
3. What is the biquadrate-root of 5308416? *An.* 4
4. What is the biquadrate root of 84934656? *An.* 9
5. What is the biquadrate-root of 21743271936? . . . *An.* 38

Of the SURSOLID ROOT.

Q. WHAT is a Surſolid?

A. Any number involved five times, produc a Surſolid.

Q. How is the Surſolid Root, or the Root of any oth higher power extracted?

A. By the following general rules.

1. If any even power be given, let the ſquare-root of it extracted, which reduces it to half of the given power, th the ſquare-root of that power reduces it to half of the ſa power; and ſo on till you come to a ſquare or a cube.

For example: Suppoſe a 24th power be given; the ſqua root of that reduces it to a 12th power; the ſquare root of t 12th power reduces it to a 6th power; and the ſquare-root the 6th power to a cube.

2. If any odd power be given, as the 17th, &c. obſer

(1) From the Unity Place both ways, point off at ev ſuch number of figures as in the index of the power, fo reſolvend.

(2) Seek in the table of powers for ſuch a power, (be the ſame power with the index) as comes neareſt the f period, whether greater or leſs, calling its root accordin more than juſt, or leſs than juſt.

(3) Annex ſo many cyphers to the root, as there are riods of whole numbers in the given reſolvend.

(4) Find the difference between the given reſolvend the power coming neareſt the firſt period.

(5) Whatever odd power is given, the next lowest odd power to that of the said root must be found, with its annexed cyphers: *i.e.* if the 9th power be given, find the 7th power of the root and cyphers: if the 11th power be given, find the 9th, &c.

(6) Multiply the next lowest odd power by the index of the given power, and let that product be a divisor to the difference between the given resolvend and power first found, which depresses it to a square.

(7) Point this square into periods of two figures each.

(8) Then make the first root without its cyphers a divisor, and ask how oft it may be found in the first period of the square.

(9) If the divisor be less than just, you must multiply the quotient figure by half the index, i. e. if the index be 11, multiply the quotient figure by 5; if the index be 9, multiply it by 4, &c and add it to the divisor; but if it be more than just, you must subtract it from the divisor; having a cypher annexed, or supposed to be annexed, to the divisor; which sum or difference must be multiplied by the said quotient figure, and so continued to every new figure in the quotient.

(10) If the first root with its cyphers be more than just, the quotient must be subtracted from it; but if it be less than just, it must be added to it; and the sum or difference will be the root required.

3 If an even power be given, and the square-root of that power being extracted, reduce it to an odd power; you must then proceed with that odd power as the foregoing rules direct.

Examples.

1. What is the sursolid of 6436343?

6436343

32 the nearest Sursolid, whose root and cypher is 20

3236343

The cube of 20 is = 8000

And 8000 × 5 is = 40000

Then 40000)3236343(80 Lastly 20

Again 2)80(3 + 3

3 × 2 = 6 78

divisor = 26 — 23 the sursolid

2 to be rejected. Root required.

N.B. This is a very expeditious way of extracting the roots or high powers, but it is not always exact because, as Mr. Ward observes, (for it was taken from him) there will be a remainder, and sometimes an excess or defect in the last figure of the root when the given resolvend or power hath a true root; as appears by the fifth example following, whose true root should not be 384.3 as it there stands, but 384.

2. What is the ſurſolid of 48? *An.* 254830968
3. What is the ſurſolid root of 8153726976? *An.* 96
4. What is the ſurſolid-root of 254803968? *An.* 48
5. What is the ſurſolid-root of 8349416423424? *An.* 384

Of the SQUARE CUBE-ROOT.

Q. WHAT is a Square Cube?
A. Any number involved ſix times, produces a Square-Cube.

Examples.

1. What is the ſquare cube of 48.? *An.* 1223059046
2. What is the ſquare cube-root of 782757789696? *An.* 9
3. What is the ſquare cube-root of 122305904 64? - - - - - - *An.* 4
4. What is the ſquare-cube root of 3206175906594816? - - - - *An.* 38

Of the SECOND SURSOLID ROOT.

Q. WHAT is the Second Surſolid?
A. Any number involved ſeven times produces a Second Surſolid.

Examples.

1. What is the ſecond ſurſolid of 96? - - - - - - - - *An.* 7514.7478108
2. What is the ſecond ſurſolid root of 71447478 10816? - - - - - - - *An.*
3. What is the ſecond ſurſolid root of 587068342272? - - - - - - - *An.*
4. What is the ſecond ſurſolid-root of 12311715813 2409344? - - - - *An.* 384

Of the SQUARE BIQUADRATE ROOT

Q. WHAT is a Square Biquadrate?
A. Any number involved eight times, is a Biquadrate Squared, or Square-Biquadrate?

Examples.

1. What is the ſquared Biquadrate of 48? - *An.* 2817928042 9

2. What is the ſquare biquadrate-root of 7213895789838336? - - *An.* 96.
3. What is the ſquare biquadrate-root of 28179280429056? - - *An.* 48.
4. What is the ſquare biquadrate-root of 472769874482845188096? - *An.* 384.

OF THE CUBED CUBE-ROOT.

Q. WHAT is a Cubed Cube?

A. Any number involved nine times, is a Cubed Cube?

Examples.

1. What is the cubed cube-root of 692533995824480256? - *An.* 96.2
2. What is the cubed cube-root of 1352605460594688? - *An.* 48 09
3. What is the cubed cube-root of 18154363180141255228864? *An.* 384.5

OF THE SQUARE SURSOLID-ROOT.

Q. WHAT is a Squared Surſolid?

A. Any number involved ten times, produces a ſquared ſurſolid.

Examples.

1. What is the ſquared ſurſolid root of 64925062108545024? - *An.* 48.
2. What is the ſquared ſurſolid root of 66483263599150104576? - *An.* 96.
3. What is the ſquared ſurſolid-root of 69712754611742420055883776? *An.* 384.3

OF THE THIRD SURSOLID-ROOT.

Q. WHAT is a Third Surſolid?

A. Any number involved eleven times, produces a Third Surſolid.

Examples.

1. What is the third ſurſolid-root of 952809757913927? - *An.* 23.
2. What is the third ſurſolid-root of 3116402981210161152? - *An.* 48.
3. What is the third ſurſolid-root of 6382393305518410039296? - *An.* 96.

Of the SQUARED SQUARE CUBE ROOT.

Q. WHAT is a Squared Square-Cube?

A. Any number involved twelve times produces a Squared Square-Cube.

Examples.

1 What is the root of this squared square-cube 149587343098087735296? - An. 48.

2. What is the root of this squared square-cube 6127097573297673637772416? An. 96.

3. What is the root of this squared square-cube 1027956394402909029176039807385? An. 384.

A General RULE for extracting the ROOTS of all Powers.

1 PRepare the given number for Extraction by pointing off from the unity place, as the root required directs.

2. Find the first figure in the root by your own judgement, or by inspection into the table of powers.

3. Subtract it from the given number.

4. Augment the remainder by the next figure in the given number, that is by the first figure in the next point, and call this your dividend.

5. Involve the whole root, last found, into the next inferior power to that which is given.

6. Multiply it by the index or the given power, and call this your divisor.

7. Find a quotient figure by common division, and annex it to the root.

8. Involve all the root, thus found, into the given power.

9. Subtract this power (always) from as many points of the given power as you have brought down, beginning at the lowest place.

10. To the remainder bring down the first figure of the next point for a new dividend.

11. Find a new divisor as before, and in like manner proceed till the work is ended.

Examples.

1. What is the Cube-Root of 115501303.?

```
  115501303(487
   64
  ----
48)515 dividend
  ----
   110592 subtrahend
   ---------
6912)49093 dividend
   ----------
    115501303
            0
            -
```

$4 \times 4 \times 3 = 48$ divisor
$48 \times 48 \times 48 = 110592$ subtrahend
$48 \times 48 \times 3 = 6912$ divisor
$487 \times 487 \times 487 = 115501303$ subtrahend

2. What is the Biquadrate-root of 56249134561.?

```
        56249134561.(487.
        256
        -----
    256)3064 dividend
        ----
        5308416 subtrahend
        -----------
 442368)3164974 dividend
        -----------
        56249134561 subtrahend
        ---------------
                  0
                  -
```

$4 \times 4 \times 4 \times 4 = 256$ divisor
$48 \times 48 \times 48 \times 48 = 5308416$ subtrahend
$48 \times 48 \times 48 \times 4 = 442368$ divisor
$487 \times 487 \times 487 \times 487 = 56249134561$ subtrahend.

Note. This general rule I received from my worthy friend, William Mountaine, Esq; F. R. S. and teacher of the Mathematics at Shad-Thames.

Of SIMPLE INTEREST.

Q. WHAT particular Letters are used here?

A. These: P, any principal.
T, the time.
R, the ratio, or the rate *per cent.*
A, the amount.

Q. What is the Ratio?

A. It signifies only the simple interest of 1l. for one yea[r] at any proposed rate of interest *per cent.* and is thus found

$$100 : 6 :: 1 : 0.06$$
$$100 : 5 :: 1 : 0.05$$

A Table of Ratios.

Rate per cent.	*Ratio.*	*Rate per cent.*	*Ratio.*
2	.02	$6\frac{1}{2}$	.065
3	.03	7	.07
$3\frac{1}{2}$	.035	$7\frac{1}{2}$	.075
4	.04	8	.08
$4\frac{1}{2}$	.045	$8\frac{1}{2}$	.085
5	.05	9	.09
$5\frac{1}{2}$	.055	$9\frac{1}{2}$	.095
6	.06	10	.1

Case I.

Q. When P, T, and R, are given to find A,—how is discovered?

A. Thus, $ptr \times t = a$

Note, Any quantity of letters put together like a word, denotes conti[nual] multiplication.

Examples.

1. What sum will 567l. 10s. amount to in 9 years, a[t] *per cent per annum?* *An.* £873 : 1

2. What will 508l. 14s. amount to in 1 year, at 5 *per ce[nt]* *per annum?* *An.* £534 : 2 : 8 1.6 q

3. What will 600l. 14s. amount to in 10 years, at $4\frac{1}{2}$ [per] *cent. per annum?* *An.* £871 : 0 : 3 2.4

4. What will 4000l. amount to in 5 years, at $3\frac{1}{2}$ *per c[ent]* *per annum?* *An.* £47

Note, When the time given does not consist of whole years, then re[duce] the odd time into decimal parts of a year. And, unless such par[ts of] a year chance to be just $\frac{1}{4}$ $\frac{1}{2}$, or $\frac{3}{4}$ of a year, the best way will be t[o re]duce the odd times into days, and then work with the decimal pa[rts of] a year, that are equivalent to those days.

A TABLE *for the ready finding the* Decimal Parts *of a* Year, *equal to any number of* Days, *or* Quarters of a Year.

Days.	*Decimal parts*	*Days*	*Decimal parts*	*Days*	*Decimal parts.*
1	.00274	10	.027397	100	.273973
2	.005479	20	.054794	200	.547945
3	.008219	30	.082192	300	.821918
4	.010959	40	.109589	365	1.000000
5	.013699	50	.136986		
6	.016438	60	.164383		
7	.019178	70	.191781	$\frac{1}{4}$ *of a year*	.25
8	.021918	80	.219178	$\frac{1}{2}$ *of a year*	.5
9	.024657	90	.246575	$\frac{3}{4}$ *of a year*	.75

Note, When the true number of days cannot be found at one view in this table, then both them and their decimals must be taken out of the table at twice, or thrice, as their number requires, and added together. So the decimal parts of a year = 236 days are thus found.

200 = .547945
30 = .082192
6 = .016438
236 = .646575

Examples.

5. What will 7200l. amount to in $6\frac{1}{2}$ years, at 5 *per cent. per annum?* *An* £9540.

6. What will 1110l. 18s. amount to in $12\frac{3}{4}$ years, at 5 *per cent. per annum?* *An.* £1819 : 1 : 11 : 2.8 *qrs.*

7. What will 280l. 10s. amount to in 3 years, and 148 days, at 5 *per cent. per annum?* *An.* £328 : 5 : 2 : 3.38+*qrs.*

8. What will 196l. amount to in 189 days, at 4 *per cent. per annum?* *An.* £200 : 1 : 2 : 1.23+*qrs.*

CASE II.

Q. When A, T, and R, are given to find P;—how is it discovered?

A. Thus; $\frac{a}{tr+1}=p.$

Examples.

1. I demand what principal will amount to 873l. 19s. in 9 years, at 6 *per cent. per annum?* *An* £567 10*s.*

2. I demand what principal will amount to 534l. 2s. 8d. .6qrs in 1 year at 5 *per cent per annum?* *An* £508 : 14*s.*

3. I demand what principal will amount to 9540l. in $6\frac{1}{2}$ years, at 5 *per cent per annum?* *An* £7200.

4 I demand what principal will amount to 1819l. 1s. 11d. 2.8qrs. in $12\frac{3}{4}$ years, at 5 *per cent. per ann.?* *An.* £1110 : 18*s.*

5. I demand what principal will amount to 871l. 3d. 2.4 qrs. in 10 years, at $4\frac{1}{2}$ *per cent. per annum*? *An.* £600 : 14

6. I demand what principal will amount to 4700l. in 5 years, at $3\frac{1}{2}$ *per cent. per annum*? *An.* £4000

7. I demand what principal will amount to 328l. 5s. 2d. 3.38 qrs. in 3 years and 148 days, at 5 *per cent.*

An. £280 : 10

8. What principal being put to interest for 189 days, at 4 *per cent.* will amount to 200l. 1s. $2\frac{1}{2}$d.? *An.* £106

CASE III.

Q. When A, P, and T, are given to find R;—how is it discovered?

A. Thus; $\frac{a-p}{tp}=r$

Examples.

1. At what rate *per cent.* will 567l. 10s. amount to 873l. 19s. in 9 years? *An.* £6 *per cent.*

2. At what rate *per cent.* will 508l. 14s. amount to 534l. 2s. 8d. 1.6 qr in one year? *An* £5 *per cent.*

3. At what rate *per cent.* will 7200l. amount to 9540l. in $6\frac{1}{2}$ years? *An.* £5 *per cent.*

4. At what rate *per cent.* will 1110l. 18s. amount to 1819l 1s. 11d. 2.8 qrs. in $12\frac{3}{4}$ years? *An.* £5 *per cent.*

5. At what rate *per cent.* will 600l. 14s. amount to 871l. 3d. 2.4 qrs. in 10 years? *An.* £$4\frac{1}{2}$ *per cent.*

6. At what rate *per cent.* will 4000l. amount to 4700l. in 5 years? *An.* £$3\frac{1}{2}$ *per cent.*

7. At what rate *per cent.* will 280l 10s. amount to 328l. 5s. 2d. 3.38 qrs. in 3 years and 148 days? *Ans.* £5 *per cent.*

8. At what rate *per cent.* will 196l. amount to 200l. 1s. $2\frac{1}{2}$d. in 189 days? *Ans.* £4 *per cent.*

CASE IV.

Q. When A, P, and R, are given to find T;—how is it discovered?

A. Thus; $\frac{a-p}{rp}=t$

Examples.

1. In what time will 567l. 10s. amount to 873l. 19s. at 6 *per cent*? *An* 9 years.

2. In what time will 508l. 14s. amount to 534l. 2s. 8d. 1.6 qrs. at 5 *per cent.*? *Ans.* 1 year.

3. In what time will 7200l. amount 9540l. at 5 *per cent.* *Ans.* $6\frac{1}{2}$ years.

4. In what time will 1110l. 18s. amount to 1819l. 1s. 11d. 1.8 qrs. at 5 *per cent.* *Ans.* $12\frac{3}{4}$ *years*

5. In what time will 600l. 14s. amount to 871l. 3d. 2.4 qrs at $4\frac{1}{2}$ *per cent*? *Ans.* 10 *years*

6. In what time will 4000l. amount to 4700l. at $3\frac{1}{2}$ *per cent*? *An.* 5 *years*

7. In what time will 280l. 10s. amount to 328l. 5s. 2d. 3.38 qrs. at 5 *per cent*? *An* 3 *years and* 148 *days*

8. In what time will 196l. amount to 200l. 1s. $2\frac{1}{2}$d. at 4 *per cent*? *Ans.* 189 *days*

Of Annuities or Pensions in Arrears.

Q. What is meant by Annuities or Pensions in Arrears?

A. Annuities or Pensions are said to be in Arrears, when they are payable either yearly, half-yearly, or quarterly, and are unpaid for any number of payments.

Note. U represents the annuity, pension, &c. R, T, and A, as before.

CASE I.

Q. When U, R, and T, are given to find A, how is it discovered?

A. Thus; $\frac{tut-tu}{2} \times r : + tu = a$

Examples.

1. If an annuity of 70l. be forborne 5 years, what will it amount to in that time at 5 *per cent*? *An.* £385

2. If the payment of a pension be omitted for 7 years;—what will be the amount in that time at 6l. *per cent.* when the pension is 56l *per ann.*? *An.* £462 : 11 : 2 : 1.6 *qrs.*

3. A house is let upon lease for 7 years, at 50l. *per ann.*—demand the amount for that time, at 4l. *per cent.* for the forbearance of payment? *An.* £392

4. Suppose a salary of 100l. *per ann.* be forborne 7 years, what is the amount at $4\frac{1}{2}$ *per cent*? *An.* £794 : 10s

Note. When the annuities or rents are to be paid by half-yearly or quarterly payments, as most generally they are, then,

For half-yearly payments take (always) half of the ratio, half of the yearly rent, and twice the number of years; that is, reduce the years into half years, for R, U, and T; But,

For quarterly payments, take a fourth part of the ratio, a fourth part of the yearly rent, and four times the number of years; that is, reduce the years into quarters, and work as before.

5. If 70l. annuity, payable every half-year, were unpaid 5 years; what will it amount to in that time at 5 *per cent.*? *An.* £389 : 7 : 6

6 If 70l. annuity, payable every quarter, were unpaid 5 years, what will it amount to in that time at 5 *per cent*?

An. £391 : 11 : 3

Note, By comparing these two examples with the first, it may be observed that the amount of half yearly payments is more advantageous than yearly payments, and quarterly than half yearly payments.

Case II.

Q. When A, R, and T, are given to find U;—how is it discovered?

A. Thus; $\frac{2a}{trt-tr+2t}=u$

Examples.

1. If the amount of an annuity for 5 years, at 5 *per cent* be 385l what is the annuity? *An.* £7

2. If the amount of a pension be 462l. 11s. 2d 1.6 q the time be 7 years, and the rate *per cent*. 6l. what is the pension? *An.* £5

3. If a house be let upon lease for 7 years and the amount for that time be 392l. at 4 *per cent*. what is the yearly rent? *An.* £5

4. If a salary amount to 794l. 10s in 7 years, at 4½ *per cent*. what is the salary? *An.* £100 *per annum*

Note, When the payments are half-yearly, then take 4 *a* and half the ratio, and twice the number of years; and if quarterly, then take 8 *a*, one fourth of the ratio, and four times the number of years, and proceed as before,

5. If the amount of an annuity, payable half-yearly, for 5 y at 5 *per cent*. be 389l. 7s. 6d. what is the annuity? *An.* £

6. If the amount of an annuity, payable quarterly, for 5 y at 5 *per cent*. be 391l. 11s. 3d. what is the annuity? *An.* £

Case III.

Q. When U, A, and T, are given to find R;—how is discovered?

A. Thus; $\frac{2a-2ut}{utt-ut}=r$

Examples.

1. If an annuity of 70l. *per ann.* amounts to 385l. in years; I demand the rate *per cent*? *An.*

2. If a pension of 56l. *per ann.* amounts to 462l. 11s. 1.6 qrs. in 7 years; what is the rate *per cent*? *An.*

3. If a house be let upon lease for 7 years at 50l. *per* ... *num*, and the amount for that time be 392l. what is the r *per cent*? *An.* £4 *per c*

4. If a salary of 100l. *per ann.* being forborne 7 years amou to 794l. 10s. I demand the rate *per cent*? *An.*

Note, When the payments are half-yearly, take $4a - 4ut$ for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly take $8a - 8ut$ and work with a fourth of the annuity, and four times the number of years

5. If an annuity of 70l *per annum* payable half-yearly, being forborne 5 years, amounts to 389l. 7s. 6d.—I demand the rate *per cent?* *Ans.* £5 *per cent.*

6. If an annuity of 70l *per ann.* payable quarterly, amounts to 391l. 11s. 3d. in 5 years;—I demand the rate *per cent?* *Ans* £5 *per cent.*

Case IV.——Q. When U, A, and R, are given to find T:—how is it discovered?

A. Thus; First $\frac{2}{r} - 1 = x$.

Secondly, $\sqrt{\frac{2a}{ru} + \frac{xx}{4}} : -\frac{1}{2}x = t$.

Examples.

1. In what time will 70l *per ann.* amount to 385l forborne at 5 *per cent?* *Ans* 5 *years.*

2. In what time will a pension of 56l *per ann.* amount to 461l. 11s. 2d 1.6 qr at 6 *per cent?* *An* 7 *years.*

3. If a house be let upon lease, for a certain time, for 50l. *per ann* and the amount be 392l. at 4 *per cent.*—I demand the time that it was let for? *An.* 7 *years.*

4. If a salary of 100l *per ann* being forborne a certain time amounts to 794l. 10s. at $4\frac{1}{2}$ *per cent.*—I demand the time of forbearance? *Ans* 7 *years.*

Note If the payments were half-yearly, then T will be equal to the number of half-years, or payments; but if they were to be made quarterly, then T will be equal to the number of quarterly payments.

5. If an annuity of 70l *per ann* payable half-yearly, being forborne, amounts to 389l 7s. 6d. at 5 *per cent.*—I demand the time and payments forborne? *An* 10 *payments*=5 *years.*

6. If an annuity of 70l *per ann.* payable quarterly, being forborne, amounts to 391l. 11s. 3d. at 5 *per ct.*—I demand the time and payments forborne? *An* 20 *payments*=5 *years.*

Of the Present Worth of Annuities or Pensions, &c.

Note, P represents the present worth: U, T, and R, as in the last.

Case I.

Q. When U, T, and R, are given to find P;—how is it discovered:

A. Thus; $\frac{rtt - rt + 2t}{2rt + 2} \times u = p$,

Examples.

1. What is the present worth of 50l *per ann.* to continue 6 years, at 5 *per cent*? *Ans* 259 : 12 : 3 : 2.4 + *qrs*

2. What is 80l yearly rent, to continue 5 years, worth in ready money, at six per cent? *Ans* 344 : 12 : 3 : 2.5 + *qrs*

3. What is a salary of 40l *per ann.* to continue 7 years, worth in ready money, at 4 *per cent*? *Ans* £245

4. What is a pension of 30l *per ann.* for 5 years, worth in ready money, at $4\frac{1}{2}$ *per cent*? *Ans* £133 : 9 : 4 : 2 6 + *qrs*

Note, Observe the same note here, which is given in Case I. in annuities and pensions in arrears, concerning half-yearly and quarterly payments.

5. What is the present worth of 50l *per ann* payable half-yearly for 6 years, at 5 *per cent*? *Ans* £262 : 10s

6. What is the present worth of 50l *per ann* payable quarterly for 6 years, at 5 *per cent*? *Ans* £263 : 18 : 9 : 3,6 *qrs*

CASE II.

Q. When P, T, and R, are given to find U;—how is it discovered?

A. Thus; $\frac{rt+1}{rtt-rt+2t.} \times 2p = u.$

Examples

1. There is a lease of a house 6 years to come; I demand the yearly rent, when the present worth, at 5 *per cent* is 259l. 12s. 3d. 2 qrs? *Ans* £50 *per ann.*

2. What yearly rent is that, the present worth of which for 5 years is 344l. 12s. 3d. 2 qrs at 6 *per cent*? *Ans* £80 *per ann.*

3. What salary is that which for 7 years continuance at 4 *per cent* produces 245l for the present worth? *Ans* £40 *per ann.*

4. If the present worth of a pension to continue 5 years at $4\frac{1}{2}$ *per cent* be 133l. 9s. 4d. 3 qrs.—I demand the pension? *Ans* £30.

Note When the payments are half-yearly, take half of the ratio twice the number of years, and multiply by 4 *p*; and when quarterly take one fourth of the ratio, four times the number of years, and multiply by 8 *p*.

5. There is a lease of a house, payable half-yearly, for 6 years to come;—I demand the yearly rent, when the present worth at 5 *per cent* is 262l. 10s? *Ans* £50.

6. There is a lease of a house, payable quarterly, for 6 years to come;—I demand the yearly rent, when the present worth at 5 *per cent* is 263l. 18s 9d 3,6 qrs? *Ans.* £50.

CASE III.

Q. When U, P, and T, are given to find R;—how is it discovered?

A. Thus; $\frac{2ut - 2p.}{2pt - utt - ut} = r.$

Examples.

1. I demand at what rate *per cent* will the yearly rent of 50l to continue 6 years, produce the present worth of 259l. 12s. 3d. 2 qrs? *Ans.* £5 *per cent.*

2. If the yearly rent of 80l *per ann.* to continue 5 years, bring 344l. 12s. 3d 2 qrs. present worth;—what is the rate *per cent*? *Ans.* £6 *per cent.*

3. If a salary of 40l. *per ann.* to continue 7 years, produce 245l. for the present worth;—what is the rate *per cent*? *Ans.* £4 *per cent.*

4. If a pension of 30l *per ann.* to continue 5 years, produce 133l. 9s. 4d. 2 qrs. for the present worth;—what is the rate *per cent.* *Ans.* £4½ *per cent.*

Note. When the annuities or rents, are to be paid half-yearly or quarterly, then,

For half-yearly payments, take half of the annuity, or yearly rent, and twice the number of years, that is reduce the years into half-years and then the quotient of the upper part, divided by the lower, will be the ratio of half the rate *per cent* But,

For quarterly payments, take a fourth part of the annuity, or yearly rent, and four times the number of years; that is, reduce the years into quarters, and then the quotient of the upper part divided by the lower, will be the ratio of a fourth part of the rate *per cent*

5. A lease of a house of 50l *per ann* payable half-yearly, having 6 years to come, is sold for 262l. 10.—I demand the rate *per cent.* *Ans.* £5 *per cent.*

6. A lease of a house of 50l *per ann* payable quarterly, having 6 years to come, is sold for 263l. 18s. 9d. 3 qrs.—I demand the rate *per cent*? *Ans.* 5 *per cent.*

Case IV.

Q. When U, P and R, are given to find T;—how is it discovered?

A. Thus: First, $\frac{2}{r} - \frac{2}{} - \frac{p}{u} - 1 = x.$

Secondly, $\sqrt{\frac{2p}{ru} + \frac{xx}{4}} - \frac{x}{2} = t.$

Examples.

1. If 50l yearly rent produce the present worth of 259l. 12s. 3d. 2 qrs. at 5 *per cent.*—what is the time of its continuance? *Ans.* 6 *years.*

2. I demand how long 80l *per ann.* may be purchased for 344l. 12s. 3d. 2 qrs. at 6 *per cent*? *Ans.* 5 *years.*

3. How long must a salary of 40l *per ann.* be enjoyed for 245l. at 4 *per cent*? *Ans.* 7 *years.*

4. What time may a pension of 30l. *per ann.* be bought for 133l. 9s. 4d. 2 qrs. at $4\frac{1}{2}$ *per cent*? *Ans* 5 years

Note 1 If the payments are to be half yearly, then U will be = half of the given lease, pension, &c and R will be = a half of the ratio of the given rate, and T, which is required, will be = the number of payments or half years.

2 If the payments are to be quarterly, than U will be = a fourth part of the given lease, pension, &c and R will be = a fourth part of the ratio of the given rate, and T will be = the number of the quarterly payments

5. A lease of a house of 50l *per ann.* payable half-yearly, is sold for 262l. 10s at 5 *per cent*; I demand the number of payments, and the time to come? *Ans.* 12 *payments*=6 *yrs.*

6. A lease of a house of 50 l *per ann.* payable quarterly, is sold for 263l. 18. 9d 3 qrs. at 5 *per cent*; I demand the number of payments, and the time to come?

Ans. 24 *payments*=6 *years.*

Of Annuities, Leases, &c. taken in Reversion.

Case I.

Q. How do you find the present worth of an annuity, in reversion?

A. Thus; First find the present worth of the yearly sum at the given rate and for the time of its continuance; to do which there are given U, T, and R, to find P which is thus discovered:

$$\frac{rtt-rt+2t}{2rt+2}\times u=p$$

Secondly, Find what principal being put to interest will amount to P, at the same rate, and for the time to come before the annuity, &c. commences, and that will be the present worth of the annuity, &c. in reversion: Therefore let P be changed into A=the amount, and then there will be given A, R, and T, to find P, or the principal, which is thus discovered

$$\frac{a}{tr+1}=p.$$

Examples.

1. What is the present worth of a lease of 30l *per ann.* to continue 3 years;---but is not to commence till the end of 4 years, allowing 4 *per ct.* to the purchaser? *An* £77 : 7 : 7·4

2. I have the promise of a pension of 17l *per ann.* for 7 yrs but it does not commence till the end of 4 years, and I am willing to dispose of the same for the present payment, at the rate of 5 *per cent.*---I demand the present worth? *An.* £84 : 9 :

3. There is a legacy of 20l *per ann.* for 8 years, left to a person of 16 years of age; the time of payment is to commence at the year of perfection, *i. e.* at 21 years; but he wan

ing a sum of money, is minded to sell the same at 4 *per cent.* I demand the present worth? *An.* £115 : 3 : 0 : 1.44 *qr.*

A good natured gentleman being minded to bestow a favour upon an unthankful wretch, settled upon him an income of 55l *per ann* for 12 years, to commence 5 years after such settlement; but he wanting money to follow his extravagances, sold it at the rate of 10 *per cent* I demand how much he received for the present worth? *An* £197 . 5 : 5 : 1.792 *qr.*

CASE IV.

Q. How do you find the yearly income of an annuity, &c. in reversion?

A. Thus; First find the amount of the present worth of the yearly sum, at the given rate, and for the time before the reversion; to do which, there are given P, T, and R, to find A, which is thus discovered: $ptr + p = a$

Secondly, Find what yearly rent being sold, will produce A, for the present worth, at the same rate, and for the time of its continuance; and that will be the yearly sum required: therefore change A into P, and then there will be given P, R, and T, to find U, or the yearly sum thus:

$$\frac{rt+1}{rtt - rt + 2t} \times 2p = u$$

Examples.

1. There is a lease of a house taken for 3 years, but commences not till the end of 2 years; and the lessee would sell the same for 77l. 7s. 7.2d present payment, allowing 4 *per cent.* to the purchaser. I demand the yearly rent?

Ans. £30 *per ann.*

2. I have the promise of a pension for 7 years, which will not commence till the end of 4 years; and I have disposed of the same for the present payment of 84l. 9s 6d. allowing 5 *per cent* to the purchaser; I demand the yearly income? *Ans.* £17.

3 There is a legacy of a certain rate *per ann.* for 8 years left to a person of 16 years of age; but the time of payment must not commence till the age of perfection; and the same person wanting a sum of money, sold it for 115*l* 3*s.* 2 *qrs.* allowing 4 *per cent.* to the buyer; I demand the yearly rate? *Ans* £20

4. A good natured gentleman, being minded to bestow a favour upon an unthankful wretch settled an income upon him for 12 years, at a certain rate *per ann* to commence 5 years after such settlement: but he wanting money to follow his extravagance, sold it for 197*l.* 5*s.* 5*d.* 2 *qrs* allowing 10 *per cent.* to the buyer for present payment; I demand the yearly value?

Ans. £35.

Of Simple Interest for Days.

Q. How do you find the simple Interest of any sum of money for any number of days?

A. Multiply the interest of one pound for one day, at the given rate, by the principal, and by the number of days; the last product is the interest required.

Note, The interest of one pound for one day at

1	*per cent.*	is = .000027397260
2		is = .00005479452
3		is = .00008219178
4		is = .00010958904
5		is = .0001369863
6		is = .00016438356
7		is = .00019178082
8		is = .0002 917808
9		is = .00024657534
10		is = .0002739726

Examples.

1. What is the interest of 120l. for 126 days, at 4 *per cent?*

An £1 : 13 : 1 : 2 *qrs* +

2. What is the interest of 126 for 145 days, at 6 *per cent?*

An. £3 : 0 : 0 : 3 *qrs.* +

3. What is the interest of 100l. from the 1st of June, 1798, to the 8th of March following, at 5 *per cent.?*

An. £3 : 16 : 11 : 3 *qrs.*

4. What is the interest of 200l. from the 14th of August, 1798, to the 19th of December following, at 6 *per cent.?*

Ans. £4 : 4 : 1 : 3 *qrs* +

5. What is the interest of 10l. for 25 days, at 5 *per cent.?*

An. 8*d* +

6. What is the interest of 40l. for 40 days, at 4 *per cent.?*

An. 3*s.* 6*d.* +

Note. There is another way of answering questions in interest for days which is laid down in Case I in Simple Interest, page 132 as appears by the eight questions in that Case. The reader may use which he likes best, or both if he pleases.

Of Rebate or Discount.

Q. What particular Letters are used in Rebate?

A. These:

S, the sum to be discounted.

P, the present worth of that sum, due at any time to come.

T, the time before it becomes due.

R, the ratio, or the rate *per cent.*

Case I.

Q. When S, T, and R, are given to find P;—how is it discovered?

A. Thus; $\frac{s}{tr+1} = p.$

Examples.

1. What is the present worth of 795l. 11s. 2d. for 11 months, at 6 *per cent.*? *Ans.* £754 : 1 : 8*d* +

2. What is the present worth of 161l. 10s. for 19 months, at 5 *per cent.*? *Ans.* £149 : 13 : 0 : 3 *qrs.* +

3. If a legacy of 1000l. is left me the 24th of July, 1798, to be paid on the Christmas day following; what must I receive when I allow 6 *per cent.* for present payment?

An. £975 : 3 : 0 : 3 *qrs.* +

CASE II.

Q. When P, T, and R, are given to find S;—how is it discovered?

A. Thus; $ptr + p = s$. *Examples.*

1. Suppose I receive 754l 1s. 8d. now, for a sum of money due 11 months hence, allowing 6 *per cent.* for present payment; I demand the sum that was due at first?

An. £795 : 11 : 2.

2. There is a certain debt, payable 19 months hence, but I agree with the debtor to pay me down 149l. 13s. 0¼d. and allow him 5 *per cent.* for present payment; I demand how much the debt is? *Ans.* £161 : 10.

3. A legacy was left me the 24th of July, 1793, to be paid on Christmas day following, but I agree with the executor and allow him 6 *per cent.* for the present payment of 975l. 3s. 3 qrs.; I demand what the legacy was? *Ans* £1000.

CASE III.

Q. When S, P, and R, are given to find T;—how is it discovered?

A. Thus; $\frac{s-p}{rp} = t$.

Examples.

1. The present worth of 795l 11s. 2d. due for a certain time to come, is 754l. 1s. 8d. at 6 *per cent.*; I demand in what time the first sum should have been paid, if no rebate had been made? *Ans.* 11 *months.*

2. There is 161l. 10s. due at a certain time to come, but I allow 5 *per cent.* to the debtor, for the present payment of 149l. 13s. 3 qrs.; I demand when the sum should have been paid without any rebate? *An.* 19 *months.*

3. I have received 975l. 3s. 3 qrs. for a legacy of 1000l. allowing the executor 6 *per cent.*; I demand when the legacy was payable without rebate? *Ans.* 155 *days.*

CASE IV.

Q. When S, P, and T, are given to find R;—how is it discovered?

A. Thus; $\frac{s-p}{tp}=r$.

Examples.

1. At what rate *per cent.* will 795l. 11s. 2d. payable 11 months hence, produce 754l. 1s. 8d. for present payment? *An.* 6 *per cent.*

2. At what rate *per cent.* will 161l. 10s. payable 19 months hence, produce the present payment of 149l. 13s. 3 qrs.? *An.* 5 *per cent.*

3. Suppose a legacy of 1000l. is left me the 24th of July, 1798, to be paid on the Christmas-day following; but I agree with the executor for the present payment of 975l. 3s. 3 qrs. I demand the rate *per cent.* allowed for his money! *An.* 6 *per cent.*

Of Equation of Payments (the true way).

Q. How is the equated time for the payment of a sum of money, due at several times, found out?

A. Thus, *First,* Find the present worth of each payment for its respective time, as in Rebate, that is:

$$\frac{s}{tr+1}=p.$$

2. Add all the present worths together, and call that sum also P; then is $s-p=d$ the rebate

3. $\frac{d}{pr}=e$ is the true equated time.

Examples.

1. A owes B 200l. to be paid as follows, viz. 100l. at 2 months, and 100l. at 4 months; but they agree to have but one payment of the whole, rebate being made at 6 *per cent.* I demand the equated time? *An.* 3 *months.*

2. A merchant hath owing him 300l. to be paid as follows: 50l. at two months, 100l at 5 months, and the rest at 8 months; and it is agreed to have but one payment of the whole, rebate being made at 5 *per cent.* I demand the equated time? *Ans* 5.9796 *months.*

3. F owes to H 1000l. whereof 200l. is to be paid present, 400l. at 5 months, and the rest at 10 months; but they agree to have but one payment of the whole, at the rate of 4 *per cent.* rebate; I demand the true equated time? *An* 181 *days.*

4. A man owes a merchant 1200l. to be paid as follows: 200l. down, 500l. at the end of 10 months, and the rest at the end of 20 months; and they agree to have but one payment of the whole, rebate at 3 *per cent.* I demand the true equated time? *An,* 1 *year,* 11 *days.*

Of COMPOUND INTEREST.

Q. WHAT particular letters are used here?

A. These.

P, the principal.

T, the time

R, the amount of 1l. for 1 year, at any given rate.

A, the whole amount.

Q. How is the amount of 1l. for 1 year, at any proposed rate *per cent.* found?

A. Thus; As 100 ; 106 : : 1 : 1.06

100 ; 105 : : 1 : 1.05

A *Table of the* Amounts *of* 1*l. for One Year.*

Rates per cent	*Amts. of* 1*l.*	*Rates per ct*	*Amts. of* 1*l.*
2	1.02	$6\frac{1}{2}$	1.065
3	1.03	7	1.07
$3\frac{1}{2}$	1.035	$7\frac{1}{2}$	1.075
4	1.04	8	1.08
$4\frac{1}{2}$	1.045	$8\frac{1}{2}$	1.085
5	1.05	9	1.09
$5\frac{1}{2}$	1.055	$9\frac{1}{2}$	1.095
6	1.06	10	1.1

Case I.

Q. When P, T, and R, are given to find A; how is it discovered?

A. Thus; $p \times r^{t} = a$.

Note, R must be involved so many times as the number of years direct, and that will be r^{t}.

Examples.

1. What sum will 450l. amount to in three years time, at 5 *per cent per ann.*? *Ans.* £520 : 18 : 7 : 2 *qrs.*

2. What will 400l. amount to in 4 years, at 6 *per cent. per ann.*? *Ans.* £504 : 19 : 9 : 3.15264 *qrs.*

3. What will 480l. amount to in 6 years, at 5 *per cent. per ann.*? *Ans* £643 : 4 : 11.0178*d.*

4. What is the amount of 500l. at $4\frac{1}{4}$ *per cent. per ann.* for 4 years? *Ans.* £590 : 11 : 5 : 2.95+*qrs.*

Case II.

Q. When A, R, and T, are given to find P; — how is it discovered?

Thus; $\frac{a}{r^{t}} = p$.

Examples.

1. What principal must be put to interest, to amount to the sum of 520l. 18s. 7d. 2 qrs. in 3 years, at 5 *per cent. per ann.*? *Ans.* £450.

2 What principal will amount to 504l 19s. 9d. 3.1526 qrs in 4 years at 6 *per cent. per ann*? *Ans.* £400.

3. What principal will amount to 643l. 4s. 11.0178d. in 6 years, at 5 *per cent per ann.*? *Ans.* £480.

4. What principal will amount to 590l. 11s. 5d 3 qrs. in 4 years at $4\frac{1}{2}$ *per cent.*? *Ans.* £500.

Case III.

Q. When P, R, and A, are given to find T;—how is it discovered?

A. Thus; $\dfrac{a}{p}=r^t$ which being continually divided by *r*, till nothing remains, the number of those divisions will be $=t$.

Examples.

1. In what time will 450l. amount to 520l. 18s. 7d. 2 qrs. at 5 *per cent. per ann.*? *Ans.* 3 years.

2. In what time will 400l. amount to 504l. 19s 9d. 3.1 qrs. at 6 *per cent. per ann.*? *Ans.* 4 years.

3. In what time will 480l. amount to 643l. 14s 11.1d at 5 *per cent. per ann.*? *Ans.* 6 years.

4. In what time will 500l. amount to 590l. 11s 5d 3 qrs at $4\frac{1}{2}$ *per cent. per ann.*? *An* 4 years.

Case IV.

Q. When P, A, and T, are given to find R;—how is it discovered:

A. Thus; $\dfrac{a}{p}=r^t$ which must be extracted by the rules of extraction; the time given in the question $=t$, shewing the power.

Examples.

1. At what rate *per cent.* will 450l. amount to 520l. 18s. 7d 2 qrs. in 3 years? *An* 5 *per cent.*

2. At what rate *per cent.* will 400l. amount to 504l. 19s. 9d. 3.2 qrs. in 4 years? *An.* 6 *per cent.*

3. At what rate *per cent.* will 480l. amount to 643l. 4s. 11.1d in 6 years? *An.* 5 *per cent.*

4. At what rate *per cent.* will 500l. amount to 590l. 11s. 5d. 3 qrs. in 4 years? *An.* $4\frac{1}{2}$ *per cent.*

Of Annuities or Pensions in Arrears.

Case I.

Note, U represents the annuity, pension, &c T, R, and A, as before.

Q. When U, T, and R, are given to find A;—how is it discovered?

A. Thus; $\dfrac{ur^t - u}{r - 1} = a$.

Examples.

1. What will an annuity of 30l. *per ann.* payable yearly, amount to in 4 yrs at 5 *per cent*? *An* £129 : 6 : 0 : 3.6 *qrs.*

2. Suppose a pension of 50l. *per ann.* payable yearly, be granted to a superannuated officer;—what is the amount for 5 years forbearance at 4 *per cent.*?

Ans £270 : 16 : 3 : 3.4 + *qrs.*

3. If the yearly rent of a house which is 40l. be forborne 7 years, at 6 *per cent.*—what is the amount?

Ans. £335 : 15 : 3.3 + *qrs.*

4. If a salary of 35l. *per ann.* to be paid yearly be omitted for 6 years, at $5\frac{1}{2}$ *per cent.*—what is the amount?

Ans. £241 : 1 : 7 : 2.5 + *qrs.*

Case II.

Q. When R, T, and A, are given to find U;—how is it discovered?

A. Thus; $\dfrac{ra - a}{r^t - 1} = u$.

Examples.

1. What annuity, being forborne for 4 years, will amount to 129l. 6s. 1d. at 5 *per cent.*? *Ans.* £30 *per ann.*

2. If a pension being forborne for 5 years, at 4 *per cent. per ann.* amounts to 270l. 16s 4d. —I demand how much it is *per ann.*? *An.* £50 *per ann.*

3. If the yearly rent of a house, being forborne for 7 years, at 6 *per cent.* amounts to 335l. 15s. 0d 3.4 qrs.—I demand what the rent is? *Ans* £40 *per ann.*

4. If the payment of a salary be omitted 6 years;—I demand how much the salary is, when the amount is 241l. 1s. 8d. 2.6 qrs. at $5\frac{1}{2}$ *per cent.*? *An.* £35 *per ann.*

Case IV.

Q. When U, A, and R, are given to find T:—how is it discovered?

A. Thus; $\dfrac{ar + u - a}{u} = r^t$ $\left\{\text{which being continually divided by } r\text{, till nothing remains, the number of those divisions will be} = t.\right.$

Examples.

1. In what time will 30l. *per ann.* amount to 129l. 6s. 1d. allowing 5 *per cent.* for the forbearance of payment? *An.* 4 years

2. In what time will a pension of 50l. *per ann.* amount to 270l 16s. 4d. at 4 *per cent.* *Ans.* 5 years

3. In what time will the yearly rent of a house, being 40l *per ann.* amount to 335l. 15s. 1d. at 6 *per cent.* for non-payment? *Ans.* 7 years

4. In what time will a salary of 35l. *per ann.* amount to 241l. 1 7d. 2.6 qrs. at $5\frac{1}{2}$ *per cent.* for the forbearance of payment? *Ans.* 6 years

Note. In this and the two next Sections might be placed Case IV but because it requires an Algebraic method of proceeding in order to find R, I omit inserting it in its place; this being designed to treat only of numbers

Of the present Worth of Annuities, Pensions, &c.

Note, P, is the present worth, U, T, and R as in the last.

Case I.

Q. When U, T, and R, are given to find P; how is it discovered?

A. Thus;

$$\frac{u - \frac{u}{r^t}}{r - 1} = p.$$

Examples.

1. What is the yearly rent of 20l. to continue 6 years, worth in ready money, at 5 *per cent*? *Ans.* £101 : 10 : 3 : 3 qrs.

2. What is the present worth of a pension of 30l *per ann.* for 5 years, at 4 *per cent.*? *Ans.* £133 : 11 :

3. What must be the discount of a lease of 50l. *per ann.* when present payment is made for 4 years, at 3 *per cent.*? *Ans* £14 : 2 : 10.2 qrs.

4. A house is let upon lease for 4 years, at 70l. *per ann.* and the lessee is desirous to make present payment, provided the lessor will allow him $5\frac{1}{4}$ *per cent.*---I demand how much must be paid down, and how much discounted?

Ans. £243 : 19 . 0 : 3 *qrs. to be paid down*
36 : 0 : 11 : 1 *qr. to be discounted*

Case II.

Q. When P, T, and R, are given to find U; -- how is it discovered?

A. Thus;

$$\frac{pr^t \times r - pr^t}{r^t - 1} = u.$$

Examples.

1. What annuity or yearly rent to continue 6 years, may be purchased for 101l. 10s. 3d. 3 qrs. at 5 *per cent.*? *An* £20

2 Suppose the present payment of 133l. 11s. 1d. were required for a pension for 5 years to come, at 4 *per cent.* what is that pension? *Ans.* £30 *per ann.*

3. If the present payment of 185l. 17s. 1d. 2 qrs be made for the lease of a house, 4 years to come, at 3 *per cent.*—what is the yearly rent? *Ans.* £50 *per ann.*

4. If a house is let upon lease for 4 years, and the lessee makes present payment of 243l 19s 3 qrs. for that time, at $5\frac{1}{4}$ *per cent.*—what is the yearly rent of the house?

Ans. £70 *per annum.*

Case III.——Q. When U, P, and R, are given to find T;—how is it discovered?

A. Thus; $\dfrac{u}{p+u-pr} = r^t$ which being continually divided by r, till nothing remains, the number of those divisions will be $= t$.

Examples

1. How long may a lease of 20l. yearly rent, be had for 101l 10s. 3d 3 qrs. allowing 5 *per cent.* to the purchaser?

Ans 6 *years.*

2. I demand what time a lease of 30l *per ann.* may be purchased for; when present payment of 133l. 11s. 1d is made at 4 *per cent.*? *Ans.* 5 *years.*

3 If 185l. 17s. 1d 2 qrs. be paid down for a lease of 50l. *per ann.* at 3 *per cent.*—how long is the lease purchased for?

Ans 4 *years.*

4. A house is let upon lease at 70l *per ann.* and the lessee makes present payment of 243l. 19s 3 qrs. he being allowed $5\frac{1}{4}$ *per cent.*—I demand how long the lease is purchased for?

Ans. 4 *years.*

Of Annuities, Leases, &c. taken in Reversion.

Case I —Q. How many operations are there in Case I.?

A. Two.

Q What is the first,

A Find the present worth of the yearly sum at the given rate, and for the given time of its continuance; to do which there are given U, T, and R, to find P.

Q. How is P discovered?

A. Thus; $\dfrac{u - \dfrac{u}{r^t}}{r-1} = p.$

Q. What is the second?

A. Find what principal being put to interest will amount to P, at the same rate, and for the time to come before the annuity commences, and that will be the present worth of the annuity, &c. in reversion; therefore let P be changed into A = the amount, and then there will be given A, R, and T, to find P, or the principal.

Q. How is P discovered?

A. Thus; $\frac{a}{r^t} = p$.

Examples.

1. What is the present worth of the reversion of a lease of 20l. *per ann.* to continue 4 years, but not to commence till the end of two years, allowing 5 *per cent.* to the purchaser?

Ans. £64 : 6 : 6 : 1.4+*qrs.*

2. There is a lease of certain lands, worth 32l. *per annum,* which is yet in being for 4 years, and the lessee is desirous to take a lease in reversion for 7 years, to begin when the old lease shall be expired;—I demand the present worth of the said lease in reversion, allowing 5 *per cent* to the purchaser?

Ans. £152 : 6 : 8 : 2 *qrs.*

3. There is a house now building, which I have a mind to take a lease of for 8 years, but the house will not be finished within 2 years; I demand how much I must pay down, when the yearly rent is 100l. and the landlord allows me 4 *per cent.* on present payment? *Ans.* £622 : 9 : 7.2*d.*

CASE II.

Q. How many operations are there in Case II.?

A. Two.

Q. What is the First?

A. Find the amount of the present worth of the yearly sum at the given *rate,* and for the time before the annuity commences, to do which there are given P, R, and T, to find A.

Q. How is A discovered?

A. Thus; $pr^t = a$.

Q. What is the second?

A. Find what yearly rent being sold will produce A for the present worth, at the same rate, and for the time of its continuance, and that will be the yearly sum required. Therefore, let A be changed into P, and then there will be given P, R, and T, to find U, or the yearly sum.

Q. How is U discovered?

A. Thus; $\frac{pr^t \times r - pr^t}{r^t - 1.} = u.$

Examples.

1. What annuity or yearly rent to be entered upon 2 years hence, and then to continue 4 years, may be purchased for 64l. 6s. 6d. 2 qrs. ready money, at 5 *per cent.*? *Ans.* £20.

2. There is a lease of certain lands in being for four years, and the lessee being minded to take a lease in reversion for 7 years, to begin when the old lease shall be expired, laid down 152l. 6s 8d. 2 qrs.—I demand the yearly rent of the said lands, when allowance was made to the lessee at 5 *per cent.*

An. £32 *per ann.*

3. The present payment for the lease of a house is 622l. 9s. 7.2d. Now I have taken a lease in reversion for 8 years, which is to commence at the end of two years;—I demand how much the yearly rent is, when, for the said present payment, I was allowed 4l. *per cent.*? *An* £100 *per ann.*

Case III.—Q. How many operations are there in Case III.?

A. Two.

Q. What is the first?

A. Find what amount of the present worth of the yearly sum at the given rate, and for the time before the annuity, &c. commences; to do which there are given P, R, and T, to find A, as in Case II.

Q. How is A discovered?

A. Thus; $pr^t = a.$

Q. What is the second operation?

A. Find what time the yearly rent given, being sold for will produce A for the present worth, at the same rate, and that will be the time required: Therefore change A into P, and then there will be given U, P, and R, to find T, as in Case III. page 168.

Q. How is T discovered?

A. Thus; $\frac{u}{p + u - pr} = r^t$ which being continually divided by r, till nothing remains, the number of those divisions will be $= t$.

Examples.

1. The present worth of a certain lease in reversion is 64l. 6s. 6d. 2 qrs. the lease is 20l. *per ann.* and commences two

Years hence, and the allowance to the purchaser is 5 *per cent.* —I demand the time of its continuance? *An.* 4 *years.*

2. A certain man took a lease of some lands for a time, which by agreement was not to commence till the expiration of 4 years; the yearly rent was 31l. It was also agreed, that the purchaser should lay down 152l. 6s. 8d. 2 qrs. and be allowed for his present pay 5 *per cent.*—I demand the time that the lease was taken for? *Ans.* 7 *years.*

3. The present payment for the lease of a house is 622l. 9s. 7.2d. and the yearly rent is 100l. Now, I have taken a lease in reversion, which is to commence at the end of two years;—I demand the length of the lease, when I was allowed 4 *per cent.* for my money? *An.* 8 *years.*

Of Purchasing Real or Freehold Estates.

Q. What do you understand by a Real or Freehold Estate?

A. Such as is bought to continue for ever.

Note. U represents the yearly rent; R the amount of 1l. &c. and P, the present worth.

Case I.

Q. When U, and R, are given to find P;—how is it discovered?

A. Thus; $\frac{u}{r-1}=p$.

Examples.

1. Suppose a freehold estate of 40l. *per ann* is to be sold;—what is it worth, allowing the buyer 5 *per cent.* for his money? *An* £800.

2. What is an estate of 290l. *per ann.* to continue for ever, worth in present money allowing 4 *per cent.* to the buyer? *An.* 7250l.

Case II.

Q. When P, and R, are given to find U;—how is it discovered?

A. Thus; $p\times\overline{r-1}=u$.

Examples.

1. If a freehold estate is bought for 800l. and the allowance of 5 *per cent.* is made to the buyer;—I demand the yearly rent? *An* £40 *per ann.*

2. If an estate be sold for 7250l. present money, and 4 *per cent.* is allowed to the buyer for the same;—I demand the yearly rent? *Ans.* £290 *per ann.*

Case III.

Q. When P, and U, are given to find R;—how is it discovered?

A. Thus; $\frac{p+u}{p}=r$.

Examples.

1. If a real estate of 40l. *per ann.* be sold for 800l.—I demand the rate *per cent.*? *Ans* £5 *per cent.*

2 If a freehold estate of 290l. *per ann.* be bought for 7250l. —I demand the rate *per cent* allowed? *An.* 4 *per cent.*

Of Purchasing Freehold Estates in Reversion.

Case I.

Q. How many Operations are there in Case I.

A. Two.

Q. What is the first?

A. Find the present worth of the yearly sum at the given rate, to do which there are given U, and R, to find P.

Q. How is P discovered?

A. Thus; $\frac{u}{r-1}=p$.

Q. What is the second operation?

A. Find what principal being put to interest will amount to P, at the same rate and for the time to come before the estate commences, and that will be the present worth of the estate in reversion: Therefore let P be changed into A=the amount; and then there will be given A, R, and T, to find P=the principal.

Q. How is P discovered?

A. Thus; $\frac{a}{r^t}=p$.

Examples.

1. Suppose a freehold estate of 40l. *per ann.* to commence 3 years hence, is to be sold, what is it worth, allowing the purchaser 5 *per cent* for his present payment?

Ans. £691 : 1 : 4 : 3 *qrs.*+

2. What is an estate of 290l. *per ann.* to continue for ever, but not to commence till the expiration of 4 years, worth in present money, allowance being made at 4 *per cent.*?

An. £6197 : 6 : 7 : 1 *qr.*+

Case II.

Q. How many operations are there in Case II.?

A. Two.

Q. What is the first?

A. Find the amount of the present worth of the yearly rent, at the given rate, and for the time before the estate commences;—to do which there are given P, T, and R, to find A.

Q. How is A discovered?

A. Thus; $prt = a$.

Q. What is the second operation?

A. Find what yearly rent being sold will produce A for the present worth, at the same rate, and that will be the yearly sum required: Therefore let A be changed into P, and then there will be given P, and R, to find U, or the yearly sum.

Q. How is U discovered?

A. Thus; $\dfrac{\overline{pr \times r} - pr}{r} = u$.

Examples.

1. Suppose a freehold estate, to commence 3 years hence, is sold for 691l. 1s. 5d. allowing to the purchaser 5 *per cent.* —I demand the yearly income? *An.* 40*l. per ann.*

2. There is a certain freehold estate bought for 6197l. 6s. 7d. 1 qr. which does not commence till the expiration of 4 years; the buyer was allowed 4 *per cent.* for his money;—I demand the yearly income? *Ans.* £290 *per ann.*

Of Rebate or Discount.

Q. What particular letters are used here?

A These:

S, the sum to be discounted for.

P, the present worth of that sum, due at any time to come.

T, the time before it becomes due; and

R, the amount of 1l. for 1 year, at any rate *per cent.*

Case I.

Q. When S, T, and R, are given to find P;—how is it discovered?

A. Thus; $\dfrac{s}{r^t} = p$.

Examples.

1. What is the present worth of 520l. 18s. 7d. 2 qrs. payable 3 years hence, at 5 *per cent.*? *Ans* £450

2. There is a debt of 504l. 19s. 9d. 3 qrs. which is not due until 4 years hence; but it is agreed to be paid in present money;—what sum must the creditor receive, allowing the rebate at 6 *per cent.* to the debtor for his money? *Ans.* £400.

3. If 643l. 4s. 11d. be payable in 6 years time, what is the present worth, rebate being made at 5 *per cent.*?

Ans. £480.

CASE II.

Q. When P, T, and R, are given to find S; how is it discovered?

A. Thus; $p \times r^t = s$.

Examples.

1. If 450l. be received for a debt, payable 3 years hence, and an allowance of 5 *per cent.* was made to the debtor for his present payment;—I demand what the debt was?

Ans. £520 : 18 : 7 : 2 *qrs.*

2. There is a sum of money, due at the expiration of 4 years, but the creditor agrees to take 400l. down, allowing 6 *per cent.* on present payment;—I demand what the debt was?

An. £504 : 19 : 9 : 3 *qrs.*

3. If a sum of money, due 6 years hence, produces 480l. for present payment, rebate being made at 5 *per cent.*—I demand how much the debt was? *Ans.* £643 : 4 : 11*d.*

CASE III.

Q. When S, P, and R, are given to find T;—how is it discovered?

A. Thus; $\frac{s}{p} = r^t$ $\left\{\text{which being continually divided by } r\text{, till nothing remains, the number of those divisions will be } = t.\right.$

Examples.

1. A certain man received 450l. down for a debt of 520l. 18s. 7d. 2 qrs rebate being made at 5 *per cent.*—I demand in what time the debt was payable? *Ans.* 3 *years.*

2. There is a debt of 504l. 19s. 9d. 3 qrs. payable at a certain time, but it is agreed to pay 400l. down, at the allowance of 6 *per cent.* to the debtor for his present money:—I demand in what time the debt will become due, if no such payment was to be made? *Ans.* 4 *years.*

3. The present payment of 480l. is made for a debt of 643l 4s. 1d. rebate at 5 *per cent.*—I demand when the debt was payable? *An.* 6 *years.*

CASE IV.

Q. When S, P, and T are given to find R;—how is it discovered?

A. Thus $\frac{s}{p} = .r^t$ { which must be extracted by the rules of extraction; the time given in the question $= t$, shewing the power

Examples.

1. The present worth of 520l. 18s. 7d. 2 qrs payable 3 years hence is 450l.—I demand at what rate *per cent.* rebate is made? *Ans.* 5 *per cent.*

2. A debt of 504l. 19s. 9d. 3 qrs. will be due 4 years hence, but it is agreed to take 400l. down;—what is the rate *per cent.* that the rebate is made at? *Ans.* 6 *per cent.*

3. The sum of 643l. 4s. 11d. is payable in 6 years time; and the present worth of that sum is 480l.—I demand at what rate *per cent.* must rebate be made, to produce the said present worth? *Ans.* 5 *per cent.*

Note, 1 Equation of payments, at compound interest, should follow next but as that rule is best done by the Logarithms, the kind reader will, I hope, take this as a sufficient reason for not placing it here.

2. The whole business of Compound Interest is better performed by the Logarithms, or by tables calculated for that purpose, than otherwise, especially when the time given is very long as for 20, 30, or 40 years and when the payments are to be made half-yearly or quarterly. What is here done serves only for whole years, and shews what can be done by the pen, where the Logarithms or tables are wanting.

A practical and easy Method to cast up the VALUE OF TIMBER.

Rule. Multiply the number of feet by the price (in shillings) *per* load, and cut off 3 places to the right hand, which makes pounds and decimal parts thereof.

Examples.

754 feet at 1l. 7s. 6d. *per* load.

754	754 at 6d = 377.
27	
20358	
+377	
	£. s. d.
20.735	= 20 14 $9\frac{1}{4}$.

856 feet at 1l. 6s. *per* load. *Facit* £22 : 5 : $1\frac{1}{4}$

730 feet at £1 : 8 : 6d. *per* load. *Facit* £20 : 16 : 1d

433 feet at £1 : 3 : 6d *per* load. *Facit* £10 : 3 : 6d

Demonstration. 50 Feet make a load; therefore it is As 50 feet : price in shillings : : Feet given : Value in shillings, which $\div$ 20 are pounds: But as $50 \times 20 = 1000$, which is a divisor for pounds; therefore the first figure being 1, and the rest cyphers, division is made at once by pointing off three places above.

THE

SCHOOLMASTER'S ASSISTANT.

PART IV.

A Collection of Questions to exercise the foregoing Rules.

1. WRITE down nine hundred millions, seven hundred sixty thousand, and twenty-one.

2. What must 20s pay towards a tax, when 326l. 6s. 8d. is assessed at 41l 16s. 2d.? *Ans. 2s. 6d 2 qrs.* $\frac{77600}{78320}$.

3. If the $\frac{1}{3}$ of 6 be 2, what will the $\frac{1}{4}$ of 30 be? *An.* $7\frac{1}{2}$.

4. I demand the sum of 1738 added to itself? *An.* 3476.

5. I demand the product of 76 multiplied by itself? *An.* 5776.

6. I demand the difference between 14676 and the fourth of itself? *An.* 11007.

7. I demand the quotient of the square of 476 divided by the half of its root? *Ans.* 952.

8. There is in 3 bags, the sum of 1468l *viz.* in the first bag 461l. in the second 581l. I demand what is in the third bag? *Ans* £426.

9. What number is that which being multiplied by 13, the product will be 221? *Ans* 17.

10. Two persons, A and B, owe several debts; the lesser debt, being that of A is 2173l. the difference is 371l. what is the debt of B? *Ans.* £2544.

11. A captain and 160 sailors took a prize, worth 1360l. of which the Captain had $\frac{1}{5}$ for his share, and the rest was equally divided among the sailors; what was each man's part?

Ans. The captain had 272l. and each sailor had 6l. 16s.

12. An ancient lady being demanded how old she was: to avoid a direct answer, said, I have 9 children, and there are 3 years between the birth of each of them; the eldest was born when I was 19 years old, which is now exactly the age of the youngest: how old was the lady? *Ans 62 years old.*

13. What number is that from which if you take 341, the remainder will be 726? *An.* 1067.

14. What number is that which being added to 168, mak the sum to be 706? *An.* 538

15. What number is that which being divided by 19, th quotient will be 72? *An* 1368

16. A broker bought for his principal, in the year 1720 400l. capital stock in the South Sea, at 650l. *per cent.* and sol it again when it was worth but 130 *per cent.* how much wa lost in the whole? *An. l.*2080

17. The sum of two numbers is 4139, their difference i 948; what is the lesser number? *An.* 1595.

18. A gentleman went to sea at 17 years of age; 8 year after that he had a son born, who lived 46 years, and die before his father; after whom the father lived twice 20 year and then died also: I demand the age of the father when h died? *An.* 111 *year*

19. Three Gardeners, A, B, and C, having bought piece of ground find the profits of it amount to 120l. *p ann.* Now the sum of money which they laid down was such proportion, that as often as A paid 5l. B paid 7l. an as often as B paid 4l. C paid 6l. I demand how much eac man must have *per annum* of the gain?

	B.		*A.*		*B.*		*A*
As	7	:	5	: :	4	:	$2\frac{6}{7}$
	A.		*C.*		*A.*		*C.*
	$2\frac{6}{7}$	:	6	: :	5	:	$10\frac{1}{2}$

		l.	*s.*	*d.*
An.	*A*	26	13	4
	B	37	6	8
	C	56	0	0
		120	0	0

20. A, B, and C, freight a ship with wine, viz. A lays o 1342l.; B 1178l.; C 630l. the whole 212 tuns, are sold 32l. *per* tun; what shall each man receive?

		l.	*s.*	*d.*	*qrs.*
An.	*A*	2890	3	11	$3\frac{1230}{3150}$
	B	2537	$\frac{2}{3150}$		
	C	1356	16	0	

21. A, B, and C, made up a stock of 1000l. whereof put in 409l. B 198l. and they improved it to 1964l. I d mand what was the stock of C, and what was each man share of the whole gain?

An.	*C's stock was*	393	0	0
	A's share was	803	5	$6\frac{240}{1000}$
	B's - -	388	17	$5\frac{280}{1000}$
	C - - -	771	17	$0\frac{480}{1000}$

22. A, B, and C, freight a ship for the Canaries worth 3696l. whereof A put in 369l. B 897l. but by reason of a storm, one third of the goods were cast overboard;—I demand each man's share of the loss?

Ans. A's loss was 123*l.*; *B's* 299*l.*; *and C's* 810*l.*

23. A and B traded together and gained 100l. A put in 640l B put in so much that he must receive 60l. of the gain; – I demand how much B put in? *Ans.* £960.

24. What is the value of 27 doz. 10lb. of candles, at 5d. *per* lb.? *An.* £6 : 19 : 2.

25. Bought 28 qrs. 2 bushels of wheat, at 4s. 6d. *per* bushel; what is the worth of it? *An.* £50 : 17*s.*

26. If a man earns 2s. 6d. 2 qrs. per day;—how much is that for 19 weeks, Sundays excepted: *An.* £14 : 9 : 9.

27. A, B, and C, traded together; the first laid in I know not how much; B put in 20 pieces of cloth; and C put in 500l and they have gained 1000l. whereof A ought to have 350l. and B 400l.—I demand C's share, how much the first man laid in, and what the 20 pieces of cloth were worth?

An. C's share was 250*l.*; *A laid in* 700*l.*; *and B's Cloth was worth* 800*l.*

28. A merchant buys up six bags of Canterbury hops, No 1. of which weighed 3 cwt. 3 qrs. 20 lb. No 2. 3 cwt. 1 qrs 26 lb. No 3. 3 cwt 24 lb. No 4. 3 cwt. 3 qrs. only, No 5. 2 cwt 2 qrs. 22 lb. No 6. 2 cwt 2 qrs 26 lb.; besides 5 pockets, 3 of which weighed $76\frac{1}{4}$ lb each; and the other two $62\frac{1}{4}$ lb. each; how many cwt. has he to pay carriage for? *An.* 23 *cwt.* 24 *lb.*

29 How many ducats must I deliver at Venice to receive at London 178l. 2s. the Exchange being at 4s. 4d. *per* Ducat? *An.* 822 *ducats.*

30. A traveller would change 500 French Crowns at 4s. 6d. *per* crown into sterling money, but he must pay a halfpenny *per* crown for change; how much must he receive?

An. £111 : 9 : 2.

31. When a factor taketh 1l. *per cent.* for his commission, what must he have for 743l. 17s. 3d.?

Ans £7 : 8 : 9 : 1 *qr.* $\frac{102}{2400}$.

32. Two merchants in company gained 100l. A laid in so much, that for his share of the gain he must have 60l. B laid in 720 ducats at 6s. 8d. *per* ducat; I demand how much A laid in, and what the ducats were worth?

An. A laid in 360*l. and the ducats were worth* 240*l.*

33. There were two merchants who traded in company; the first laid in the sum of 640l. and took $\frac{5}{8}$ of the gain; I demand how much the second merchant laid in? *An* £384

34. What number is that, which being multiplied by 15 the product will be $\frac{1}{4}$? *An.* $\frac{1}{20}$

35. I demand the $\frac{5}{8}$ of 20s? *An.* 12*s.* 6*d.*

36. What fraction is that, to which if you add $\frac{2}{5}$ the sum will be $\frac{5}{8}$? *An.* $\frac{13}{20}$

37. What number is that, to which if you add $7\frac{3}{5}$ the whole will be $12\frac{1}{8}$? *An.* $4\frac{7}{1}$

38. What number is that, from which if you take $\frac{3}{5}$ the remainder will be $\frac{1}{8}$? *An* $\frac{2}{4}$

39. What number is that, from which if you take $13\frac{1}{2}$ the remainder will be $5\frac{5}{7}$? *An.* $19\frac{3}{1}$

40. What number is that, which being divided by $\frac{3}{4}$ the quotient will be 21? *An.* 15

41. What number is that, which being multipled by produceth $\frac{1}{4}$? *An*

42. What number is that, from which if you take $\frac{2}{3}$ of itself, the remainder will be 12? *An* 2

43. What part of 25 is $\frac{5}{8}$ of a unit? *An*

44. What number is that, to which if you add its own the whole will be 20? *An.* 1

45. What number is that which maketh 9 to be the $\frac{2}{3}$ it? *An* 13

46. If a cannon may be discharged at twice with 6 lb powder how many times will 7 cwt. 3 qrs. 17 lb discharge the same piece? *An* 295 *times*

47. If $\frac{3}{8}$ of a ship be worth 3740l. what is the whole worth? *An.* £9973 : 6 : 8

48 A young man received 210l. which was $\frac{2}{3}$ of his elder brother's portion; Now three times the elder brother's portion was half the father's estate; I demand how much the estate was? *An.* £189

49. A factor bought a certain quantity of broad cloth and drugget, which together cost him 81l. The quantity of broad cloth that he bought was 50 yards at 18s. *per* yard, and for every five yards of broad cloth he had 9 yards of drugget; I demand how many yards of drugget he had, and how much the drugget cost him *per* yard?

An. 90 *yards of drugget, at* 8*s. per yard*

50. A certain usurer lent out 90l. for 12 months and received principal and interest 95l. 8s.—I demand at what rate *per cent* he received interest? *An.* £6 *per cent.*

51. Two men depart both from one place, the one goes north and the other south, the one goes 7 miles a-day, and the other 11 miles a-day; how far are they distant the 12th day after their departure? *An* 216 *miles.*

52 A merchant bought 8 tuns of wine, which having received damage, he sold for 400l. and 12l *per cent.* loss;—I demand how much it cost him *per* tun, and how he sold it *per* gallon, to lose after the said rate?

An. { *Cost* £56 : 16 : 4 : 1 *qr.* $\frac{5}{11}$ *per tun.*
Sold at 0 : 3 : 11 : 2 *qrs.* $\frac{960}{1016}$ *per gallon.*

53. Two men depart both from one place, and both go the same road; the one travels 12 miles every day, the other 17 miles every day;—how far are they distant the 10th day after their departure? *An.* 50 *miles.*

54. If a gentleman hath an estate of 1000l. *per ann.*—how much may he spend one day with another, to lay up threescore guineas at the year's end? *An.* £2 : 11 : 4*d* $\frac{40}{365}$.

55. If 76lb. of cinnamon cost 40l. 10s. 8d. and 1 cwt. of nutmegs 59l. 14s. 8d.—I demand the price of 3 oz. one with another? *An.* 2*s.*

56 A grocer delivered 17 cwt. 3 qrs. 10 lb. of tobacco in the roll, to be cut and dried, and when it came home, it held out 16 cwt 14lb.—I demand how much was lost in every lb. and also, supposing it cost in the roll $8\frac{6}{7}$d *per* lb. and the cutting, $1\frac{5}{8}$d *per* lb. I demand what it now stands him in?

An. { *Lost per lb.* 1 *oz.* 8 *dr.* $\frac{1200}{1998}$.
It stands him in £87 : 5 : 3 : 1 *qr.* $\frac{16}{56}$.

57. If tallow be sold for 4d. *per* lb—what is the value of 3 tubs, each 3 cwt. 1 qr. 10 lb gross, tare *per* tub 25lb? *An.* £17 : 9*s.*

58 Shipped from Spain 10 tuns of wine at 10l sterling *per* hhd paid custom at the port of London 1s *per* gallon: the charges for lighterage, cartage, and porterage, amounted to 5l afterwards by the misfortune of a pipe staving, containing 126 gallons, I lost 59 gallons; the next day 28 gallons more run out, and the remainder of the pipe not being saleable, I threw it away: The market price not running high, I sold the rest for 17l. *per* hhd —I demand how much I gained or lost by the sale of the said wine? *An.* *Gained* £115.

59. A ſhip's company took a prize of 300l. which is to be divided among them as parties, according only to their pay, and the time they have been on board; the officers and midſhipmen 5 months, and the ſailors 3 months. The officers, one with another, had 40s. *per* month; the midſhipmen 30s. *per* month, and the ſailors 22s. There were 6 officers, 12 midſhipmen, and 84 ſailors; —what muſt each party have of the prize, and what each ſingle perſon?

An.	*l.*	*s.*	*d.*	*qr.*		*l*	*s.*	*d*	*qr.*
The Officers	144	4	7	$1\frac{224}{476}$	*each man*	24	0	9	0+
Midſhipmen	108	3	5	$2\frac{64}{476}$		9	0	3	1+
Sailors -	57	11	11	$0\frac{128}{476}$		0	11	3	3+

60. If 1000lb. of beef ſerve 240 men 8 days,—how many lb. will ſerve 460 men 10 weeks?

An. 16770*lb.* 13 *oz.* $\frac{2640}{3926}$.

61. What is the amount of 1000l. for 5 years and an half at $4\frac{1}{2}$ *per cent* ſimple intereſt? *An* £1261 : 5*s.*

62. Sold goods amounting to the value of 700l. for two 4 months; —What is the preſent worth, at 5 *per cent.* ſimple intereſt? *An.* £682 : 19 : 5*d* 2 *qrs.*

63. A merchant bought 400 cloths, at 12l. *per* cloth, which he ſhipped for Spain, to have returns from thence, the one half in wine, at 30l. *per* tun, and the other half in rice, at 28s. *per* cwt.—I demand how much of each muſt be returned for the cloth?

An. 80 *tuns of wine, and* 1714 *cwt.* 1 *qr.* 4*lb of rice.*

64. A tobacconiſt hath ſeveral ſorts of tobacco, viz of 12d. *per* lb. of 16d *per* lb. of 18d *per* lb. and of 2s *per* lb. and he is deſirous to make a mixture of an cwt. worth 20d. *per* lb — I demand how much of each ſort muſt be taken.

An.	*lb*	*oz.*	*d. per lb.*
	17	$3\frac{18}{26}$	*at* 12
	17	$3\frac{18}{26}$	*at* 16
	17	$3\frac{18}{26}$	*at* 18
	60	$4\frac{24}{26}$	*at* 24

65. A brewer mixed 17 gallons of ale at 8d. *per* gallon, with 19 gallons at 10d. *per* gallon, and with 40 gallons at 6d *per* gallon.—I demand what one gallon of this mixture is worth, and alſo the worth of the whole quantity?

An. { £0 : 0 : 7 : 1 *qr.* $\frac{50}{76}$ *per gallon.*
2 : 7 : 2 : 0 *the pipe of the whole mixture*

66. There are two numbers, the one 48, the other twice as much; —I demand the difference between their ſum and difference? *An.* 96.

67. There are two numbers, the one 63, the other half as much;—I demand the product of their ſquares and the difference of their product and ſum.

An. { *Product of the ſquares* 3938240.25
{ *Difference* - - 1890

68. There are two numbers, the one 25, the other the ſquare of 25; I demand the ſquare root of the ſum of their ſquares? *An* 625.4998+

69. There are two numbers, whoſe product is 1058, and multiplicand 46; I demand the multiplier, the ſum of their factors, and the difference between the ſum of the cubes of the factors, and the ſquares of the product:

An. { *Multiplier* - - 23.
{ *Sum of the factors* 69.
{ *Difference* 1009861.

70. There are two numbers, whoſe dividend is 1216, and the quotient 76; I demand the diviſor, the difference between the cube of the quotient, and the ſum of the ſquares of the diviſor and dividend, and the cube root of the ſum of the cubes of the diviſor, dividend and quotient?

An. { *Diviſor* - 16.
{ *Difference* 1039936.
{ *Cube-root* - 1216.

71. Two men ſet out at the ſame time from the ſame place but go contrary ways; and they travel each of them 34 miles a-day; I demand the time in which they will have travelled 2000 miles? *An.* 29 *days*, 9 *hours*, 52 *min* $\frac{64}{68}$.

72. Six rogues, viz. A, B, C, D, E, and F, having entered into a confederacy, do agree to divide whatever ſums of money they ſhall at any time take upon the highways, according to their valour, that is, in proportion to the number of ſcars they ſhould then have on their faces: Now the firſt two, viz. A, and B, being very bold and daring fellows, had received A 20, and B 19 ſcars; the next two, viz. C, and D, having a leſs ſhare of courage, and not caring to ſtand all brunts, had each of them but 9 ſcars; but the other two, viz. E and F, being mere cowards, always turned their backs at the leaſt oppoſition, and ſo by chance they had one a piece, and they having, at ſeveral times, ſtolen the ſum of 700l. 13s. I deſire to know how they muſt divide it?

		l.	*s.*	*d.*	*qrs.*
An.	*A must have*	237	10	2	$0\frac{8}{59}$
	B -	225	12	7	$3\frac{43}{59}$
	C -	106	17	6	$3\frac{39}{59}$
	D -	106	17	6	$3\frac{39}{59}$
	E -	11	17	6	$0\frac{24}{59}$
	F -	11	17	6	$0\frac{24}{59}$

73. There are three numbers, 17, 19, and 48; I demand the difference between the ſum of the ſquares of the firſt and laſt, and the cube of the middlemoſt? *An* 4266.

74. In 7 cheeſes, each weighing 1 cwt. 2 qrs. 5lb. how many allowances for ſeamen may be cut, each weighing 5 oz 7 dr.? *Anſ.* $3563\frac{15}{87}$ *allowances.*

75. In 81034 Rundlets of Brandy, each 18 gallons, how many groſs of bottles each $\frac{8}{9}$ of a quart?

An. 45581 *groſs,* 7 *doz.* 6 *bottles.*

76. In 731 dozen bottles of wine, each $1\frac{5}{7}$ pint, how many hhds? *An.* 29 *hhds.* 2 *gals.* 5 *pints.*

77 Sold $8\frac{1}{2}$ cwt. of ſteel, at 12d. *per* lb. how much Flemiſh money, at 33s. 8d. per pound ſterling, am I to receive for the ſame? *An.* £80 : 2 : 6*d.* $\frac{90}{240}$ *Flemiſh.*

78. If 48 taken from 120 leave 72, and 72 taken from 91 leave 19, and 7 taken from thence leave 12; what number is that out of which when you have taken 48, 72, 19, and 7, leaves 12? *An* 158.

79. A hath $\frac{1}{2}$ of a ſhip, B $\frac{1}{4}$, C $\frac{1}{16}$, D $\frac{3}{16}$; the maſter clears 120l. how much muſt each owner have?

		l.	*s.*
An.	*A must have*	60	0
	B -	30	0
	C -	7	10
	D -	22	10

80. A gentleman having 50s. to pay among his labourers for a day's work, would give to every boy 6d to every woman 8d. and to every man 16d. the number of the boys, women and men was the ſame; I demand the number of each? *An.* 20 *of each ſort.*

81. A gentleman had 7l. 17s. 6d. to pay among his labourers; to every boy he gave 6d. to every woman 8d. and to every man 16d. and there were for every boy three women, and for every woman two men; I demand the number of each? *An.* 15 *boys,* 45 *women,* 90 *men.*

82. Admit a tax of 39l. is laid on a town for the building of a bridge, and the value of the town rent is 900l *per ann.* —what shall a man pay towards it, whose income is worth 100l. *per ann* ? *Ans.* £4 : 6 : 8.

83. Suppose A hath an estate of 53l *per ann* and pays 5s. 10d. to a subsidy;—what shall B pay, whose estate is worth 100l *per ann.*? *An.* 11*s.* 0d $\frac{4}{53}$.

84. If 136l. are to be divided between two men, so as the lesser share may have such proportion to the greater as 2 to 5,—what must each man have?

		l.	*s.*	*d.*	*qrs.*
Ans.	*One must have*	38	17	1	$2\frac{6}{7}$
	The other -	97	2	10	$1\frac{1}{7}$

85. There are 1000 l. to be divided among 3 men, in such manner that if A have 3l. B shall have 5l. and C 8l.—how much must each man have?

		l.	*s.*
Ans.	*A must have*	187	10
	B -	312	10
	C -	500	0

86. Shipped for Jamaica 550 pair of stockings, at 11s. 6d. *per* pair, and 460 yards of stuff, at 14d. *per* yard; in return for which I had 46 cwt. 3 qrs. of sugar, at 24s 6d *per* cwt. and 1570 lb. of Indigo, at 2s. 4d *per* lb.—what remains due to me of my adventure? *An.* £102 : 12 : 11 : 2 *qrs.*

87. If one pound ten, and forty groats
Will buy a load of hay;
How many pounds with nineteen crowns
For twenty loads will pay? *An* £38 : 11 : 8.

88. A man driving his geese to the market, was met by another, who said, good morrow master with your hundred geese. Says he, I have not an hundred; but if I had half as many as I now have, and two geese and an half, beside the number I have already, I should have an hundred: how many had he? *An.* 65.

89. If a tower be 384 feet high from the foundation, and a sixth part be under the earth, and an eighth part under the water;—how much in height is visible? *An.* 272 *feet.*

90. A merchant would lay out in spices 560l. at the following prices, viz. cloves at 4s. *per* lb. mace at 7s. cinnamon 3s. nutmegs at 12s. and pepper at 2s. *per* lb. and he would have an equal quantity of each sort;—I demand that quantity? *An.* 400 *lb. of each sort.*

91. The computed distance between London and York is 150 miles; now if a man sets out from London and walks every day towards York 20 miles, and back again towards London 15 miles;—how long will it be before he gets to his journey's end? *An.* 27 *days.*

92. Bought 127 pieces of cloth, for which I delivered 3589 ells of holland, at 7s. 11d *per* ell English,—what cost a piece of that cloth? *An.* £11 : 3 : 8 : 2 *qrs.* $\frac{94}{127}$.

93. The account of a certain school is as followeth, viz. $\frac{1}{16}$ of the boys learn geometry, $\frac{3}{8}$ learn grammar, $\frac{3}{16}$ learn arithmetic, $\frac{3}{20}$ learn to write, and 9 learn to read;—I demand the number of each? *An.* 5 *geometers,* 30 *grammarians,* 24 *arithmeticians,* 12 *writers, and* 9 *readers.*

94. I have laid out for a merchant 638l. 17s. 3d. he allows me $2\frac{1}{4}$ *per cent.* before that I owed him 184l. 17s. 9d. how much is he indebted to me? *An.* £471 : 10 : 10 : 1 *qr.*

95. Bought a tun of wine for 78l 17s. at what price must I sell it per quart to gain 5l. 10s. by the whole, when there were 22 gallons leaked out? *An.* 22*d.*+

96. If out of 10s. *per* week I lay up 4d. 2 qrs. *per* day, Sundays excepted, and have saved 9l. 2s. 3d how long was I in laying up, and how much have I spent in that time?

Ans. { 576 *days in laying up.*
£31 : 7 : 9 *spent* }

97. If I buy 1000 ells Flemish of linen for 90l —what may I sell it at *per* ell in London, to gain 10l by the whole.

Ans. 3*s.* 4*d. per ell.*

98. Bought threescore pieces of Holland for three times as many pounds, and sold them again for 4 times as much: but if they had cost me as much as I sold them for,—what should I have sold them for, to gain after the same rate?

An. £320

99. There are three quantities of silver, each of the same weight, but different in value; the weight of each quantity is 10 oz. the value of the first sort is 4s *per* oz. of the second 4s. 6d. *per* oz. and of the third 5s. *per* oz.—I demand the worth of an oz. when they are all melted together?

An 4*s.* 6*d. per oz.*

100. I have received advice from my factor, that he has disbursed upon my account the sum of 4000 guilders, [illegible] stivers;—I demand what sum I must answer for that in English money, exchange at par; and also what his commission comes to at 2 *per cent.*

Ans. { £400 : 1 : $6\frac{1}{4}$*d. sterling.*
8 : 0 : 0 1 *qr. commission.* }

101. A merchant bought a parcel of jewels for 220l and sold them again for 440l payable at the end of 6 months;—I demand what the gain was worth in ready money; Rebate being made at 6 *per cent.* *An* £213 : 11 : 10+

102. A factor bought 4 chests of sugar, the mark and weight as follows;

	C.	qrs.	lb.
A - -	10	3	14
B - -	12	1	17
C - -	13	1	19
D - -	11	2	10

Now suppose the tare or weight of every chest, when it is empty, to be 38lb.—I demand the neat weight of the said sugar; also I demand the prime cost of the same, supposing it came to 18s *per* cwt. including the charges of lighterage, porterage, warehouse-room, custom, &c. also I demand the whole gain, and the gain *per cent.* supposing the chests A and B were sold afterwards at 28s.*per* cwt. and the other two chests, viz C and D, at 4d *per* lb.?

Ans. { *Prime cost* - £42 : 4 : 8¼*d.*
Whole gain - 34 : 16 : 4½
Gain per cent - 82 : 8 : 9½

103 A gentleman a chaise did buy,
A horse and harness too;
They cost the sum of threescore pounds,
Upon my word 'tis true;
The harness came to half of th' horse,
The horse twice of the chaise
And if you find the price of them,
Take them and go your ways.

An. { *Chaise* - £15
Horse - 30
Harness - 15

104. A gentleman courted a young lady, and as their birthdays happened together, they agreed to make that their wedding day. On the day of marriage it happened that the gentleman's age was just double to that of the lady's, that is as 2 to 1. After they had lived together 30 years, the gentleman observed that his lady's age drew nearer to his, and that his was only in such proportion to her's as 2 to 1$\frac{3}{7}$. Thirty years after this the same gentleman found his and his lady's ages to be as near as 2 to 1$\frac{3}{5}$; at which time they both died. I demand their several ages, at the day of their marriage and of their death; also the reason why the lady's age, which was continually gaining upon her husband's, should notwithstanding be never able to overtake it?

A ſhort Collection of Pleaſant and Diverting

QUESTIONS.

1. A General having a caſtle, ſituate on a ſquare, and garriſoned by 48 ſoldiers, ſo ordered them as that any two corners and the ſide between them ſhould conſiſt of 18 men; but he thinking there were not men enough, hired 8 more, but ſtill kept up the ſame number of 18 men as before; afterwards 16 men were paid off, he not having occaſion for them; but yet he kept up his number of 18 men; I demand how he muſt place the ſaid men, to make 18 every way, when he had 48, 56 and 40 ſoldiers.

2. A poor woman carrying ſome eggs to market, met with a rude fellow, who broke them all; but preſently after conſidering what he had done, went back and told the woman he was willing to make ſatisfaction, provided ſhe could tell how many there were; ſhe anſwered ſhe could not tell, but the beſt account that ſhe could give, was, that when ſhe told them in by two at a time, there was one left, when by three, there was one left, and when by four there was one left, but when ſhe told them in by five, there was none left:---I demand how many eggs the woman had?

3. A gentleman's ſervant went to the market with an order to buy 20 fowls for 20d, he did ſo; and brought home pigeons at 4d. a-piece, larks at a half-penny a-piece, and ſparrows at a farthing a-piece:---I demand how many there were of each ſort?

4. Suppoſe the 9 digits to be placed in a quadrangular form:---I demand in what order they muſt ſtand, that any three figures in a right line may make juſt 15

5. Let 12 be ſet down in 4 figures, and let each figure be the ſame.

6. A countryman having a fox, a gooſe, and a peck of corn, in his journey came to a river, where it ſo happened that he could carry but one over at a time. Now, as no two were to be left together that might deſtroy each other, he was at his wits end how to diſpoſe of them: For ſays he, Though the corn cannot eat the gooſe, nor the gooſe eat the fox, yet the fox can eat the gooſe and the gooſe eat the corn. The queſtion is,---how he muſt carry them over, that they might not devour each other?

7. Three jealous huſbands with their wives, being ready to paſs by night over a river do find at the water ſide a boat which can carry but two perſons at once, and, for want of a waterman, they are neceſſitated to row themſelves over the river at ſeveral times; The queſtion is,---how theſe 6 perſons ſhall paſs by 2 and 2, ſo that none of the three wives may be found in the company of 1 or 2 men, unleſs her huſband be preſent?

8. Two merry companions are to have equal ſhares of 8 gallons of wine, which are in a veſſel containing exactly 8 gallons: Now to divide it equally between them, they have only two other empty veſſels of which one contains 5 gallons and the other 3. The queſtion is,---how they ſhall divide the ſaid wine between them by the help of theſe 3 veſſels ſo that they may have gained 4 gallons a-piece? *Wingat*

9. Says Jack to his brother Harry I can place four threes in ſuch manner that they ſhall make juſt 34;---can you do ſo too?

THE

SCHOOLMASTER'S ASSISTANT.

PART V.

OF DUODECIMALS.

Q. WHAT are Duodecimals?

A. They are fractions of a foot, or of an inch, or any part of an inch, having 12 for their denominators.

Notation of Duodecimals.

Q. HOW do you write Duodecimals?

	F.	I.	″	‴	⁗	
A. Thus;	3	7	2	3	7,	&c.

Q. How do you read them?

A. Thus; 3 feet, 7 inches, 2 seconds, 3 thirds, 7 fourths, &c.

Note, 1, Some call the inches primes, and mark them thus, 7′.
2. Though this manner of dividing and subdividing a foot is endless, yet, it is only so in imagination, and cannot be reduced to practice, because a second, or the twelfth part of an inch is so small, as to be incapable of any further division.

Addition of Duodecimals.

Note,	12 Fourths	make	1 Third.
	12 Thirds	—	1 Second.
	12 Seconds	—	1 Inch.
	12 Inches	---	1 Foot.

Examples.

F.	I.	″	‴	⁗
14	4	3	5	6
17	10	11	10	4
16	3	7	5	8
19	1	10	11	11
19	3	5	7	11
46	4	9	10	6

F.	I.	″	‴	⁗
28	4	3	7	10
36	10	3	11	5
19	10	4	7	6
39	5	6	9	4
47	6	2	10	11
92	11	10	3	7

A joiner having finished several very curious pieces of workmanship, would know the contents of the whole; now the first piece measured seventeen feet, ten inches, two seconds, and one third; the second measured twenty feet four inches, and seven thirds; the third forty-nine feet, six inches, and nine seconds; the fourth fourscore feet, and ten seconds; the fifth seventeen feet and four thirds; the sixth three-score feet, and ten seconds; and the seventh thirty-seven feet, and nine thirds:—What was the contents in square measure?

Subtraction of Duodecimals.

Examples.

	F.	I.	″	‴	⁗
From	74	3	4	7	6
Take	19	4	1	8	10

F.	I.	″	‴	⁗
100	5	7	3	1
97	8	9	10	11

A joiner having lined several rooms very curiously, with cedar, finds the amount to be, in square measure 800 f. 3 in. 4″; but several deductions being to be made for windows, arches, &c. those deductions amounted to 76 f. 3 in 7″ 18‴ 5⁗:—How many feet of workmanship must be paid for?

Multiplication of Duodecimals, commonly called Cross Multiplication.

Note, Feet multiplied by feet give feet.
Feet multiplied by inches give inches.
Feet multiplied by seconds give seconds.
Inches multiplied by inches give seconds.
Inches multiplied by seconds give thirds.
Seconds multiplied by seconds give fourths, &c.

EXAMPLES. 1. *Of feet and inches.*

	F.	I.	
Multiply	7	3	
By	4	7	
	29	0	″
	4	2	9
Product	33	2	9

1. Here I multiply 7 f. 3 in. first by 4 feet (which give feet and inches for the product) saying 4 times 3 is 12, set down 0 and carry 1; then 4 times 7 is 28 and 1 is 29, which set down.

2. Next I multiply the same 7 f. 3 in. by 7 inches (which give inches and seconds for the product) saying 7 times 3 is 21, set down 9 seconds and carry 1 inch; then 7 times 7 is 49 and 1 is 50 inches, or 4 feet 2 inches, which set down; then add them together, and the whole is 33 f. 2 in. 9 sec.

	F.	I.		F.	I.		F.	I.		F.	I.	
Multiply	7	5		4	6		9	7		8	3	
By	3	9		5	8		9	7		6	4	
Product	27	9	9	25	6		91	10	1	52	4	

	F.	I.		F.	I.		F.	I.	
Multiply	4	7		3	8		9	7	
By	5	10		7	6		3	6	
Product	26	8	10	27	6		32	6	6

	F.	I.		F.	I.		F.	I.	
Multiply	3	11		6	5		7	10	
By	9	5		7	6		8	11	
Product	36	10	7	48	1	6	69	10	2

The truth of any one of these operations may be proved by reducing the factors into inches, and dividing their product by 144, the number of square inches in a foot square, the quotient will be the answer, viz.

First Sum.

1. *By whole numbers.*

F.	*I.*	*I.*
7	3 =	85
4	7 =	55

```
        435
       435
  144)4785(33
       432
       465
       432
        33
        12
  144)396(2
      288
      108
       12
  144)1296(9
      1296
         0
```

2. *By Vulgar Fractions.*

Multiply *F.* $7\frac{3}{12}$

By $4\frac{7}{12}$

$$\frac{87}{12} \times \frac{55}{12} = \frac{4785}{144}$$

Then divide the numerator by the denominator, as before.

3. *By Decimals.*

```
Mult.  4.5833+
By        7.25
     229165
     91666
    320831
   33.228915
          12
    2.747100
          12
    8.9652
```

	F.	*I.*	"	
Facit	33	2	9	*nearly.*

Note. When the number of feet happens to be large in either or both of the factors, instead of multiplying by inches, (if any be) you may take parts with them.

Examples.

	F.	*I.*	
Multiply	76	7	
By	48	9	
76×8 =	608		
76×4 =	304		
48×7 =	28		‴
$6\frac{1}{2})$	38	3	6
$3\frac{1}{2})$	19	1	9
Product	3733	5	3

F.	*I.*	
46	7	
39	8	
1847	9	8
F.	*I.*	
76	7	
19	10	
1518	10	10

F.	*I.*	
71	7	
84	6	
6048	9	6
F.	*I.*	
36	1	
18	8	
673	6	8

	F.	I.			F.	I.			F.	I.		
Multiply	84	3			48	7			79	8		
By	95	2			26	8			38	11		
Product	8017	9	6		1295	9	8		3100	4	4	

	F.	I.			F.	I.			F.	I.		
Multiply	117	6			767	5			7691	10		
By	184	8			198	3			1976	11		
Product	23545	0			152140	4	3		15206113	6	2	

2. *Of Feet, Inches, and Seconds.*

	F.	I.	"				F.	I.	"		F.	I.	"	
Multiply	7	3	2				8	6	9		3	10	6	
By	1	7	3				7	3	8		7	4	8	
	7	4	2	'''			62	6	7	9	28	7	7	
	4	2	10	2	''''									
		1	9	9	6									
Product	11	7	9	11	6									

F.	I.	"				F.	I.	"			F.	I.	"		
7	1	9				3	8	4			9	8	7		
7	8	9				3	9	2			12	3	10		
55	2	9	3	9		13	10	10	4	8	119	8	2	10	10

F.	I.	"				F.	I.	"			F.	I.	"		
9	8	7				3	2	1			5	6	7		
6	5	4				2	3	4			8	9	10		
62	7	3	9	4		7	2	8	11	4	48	11	2	8	10

Note, If the number of feet is large, instead of multiplying by inches and seconds, you may take parts with them.

Examples.

	F.	I.	"		
Multiply	76	3	9		
	84	7	11		
76 × 4 =	304	0	0		
76 × 8 =	608	0	0		
3 × 84	21	0	0		
9 × 84	5	3	0	'''	
I.6½)	38	1	10	6	
1⅙)	6	4	3	9	''''
"6½)	3	2	1	10	6
3½)	1	7	0	11	3
2⅓)	1	0	8	7	6
Product	6460	7	1	8	3

F.	I.	"		
87	3	4		
18	1	7		
1582	6	2	3	4

F.	I.	"		
64	3	7		
27	2	6		
1749	5	5	11	6

F	I.	"		
49	3	1		
48	1	2		
2369	1	5	7	2

F.	I.	"		
71	3	6		
92	1	7		
6568	2	10	6	6

F.	I.	"	
71	2	6	
81	1	8	
5777	9	2	2

F.	I.	"	
56	1	8	
97	3	9	
5463	0	2	3

F.	I.	"	
756	1	8	
184	2	6	
139287	1	0	2

F.	I.	"		
371	2	6		
181	1	9		
67242	10	1	4	6

F.	I.	"		
487	11	10		
186	10	11		
91209	4	2	2	2

A Decimal Table of Inches and Seconds.

I.	S.	Decimals	I.	S.	Decimals	I.	S.	Decimals	I.	S.	Decimals
	1	.006944	1	1	.090277	2	1	.173611	3	1	.256944
	2	.013888		2	.097222		2	.180555		2	.263888
	3	.020833		3	.104166		3	.1875		3	.270833
	4	.027777		4	.111111		4	.194444		4	.277777
	5	.034722		5	.118055		5	.201388		5	.284722
	6	.041666		6	.125		6	.208333		6	.291666
	7	.048611		7	.131944		7	.215277		7	.298611
	8	.055555		8	.138888		8	.222222		8	.305555
	9	.0625		9	.145833		9	.229166		9	.3125
	10	.069444		10	.152777		10	.236111		10	.319444
	11	.076388		11	.159722		11	.243055		11	.326388
1	0	.083333	2	0	.166666	3	0	.25	4	0	.333333
I.	S.	Decimals	I.	S.	Decimals	I.	S.	Decimals	I.	S.	Decimals
4	1	.340277	5	1	.423611	6	1	.506944	7	1	.590277
	2	.347222		2	.430555		2	.513888		2	.597222
	3	.354166		3	.43765		3	.520833		3	.604166
	4	.361111		4	.444444		4	.527777		4	.611111
	5	.368055		5	.451388		5	.534722		5	.618055
	6	.375		6	.458333		6	.541666		6	.624999
	7	.381944		7	.465277		7	.548611		7	.631944
	8	.388888		8	.472222		8	.555555		8	.638888
	9	.395833		9	.479166		9	.5625		9	.645833
	10	.403777		10	.486111		10	.569444		10	.652777
	11	.409722		11	.493055		11	.576388		11	.659722
5	0	.416666	6	0	.5	7	0	.583333	8	0	.666666
I.	S.	Decimals	I.	S.	Decimals	I.	S.	Decimals	I.	S.	Decimals
8	1	.673611	9	1	.756944	10	1	.840277	11	1	.923611
	2	.680555		2	.763888		2	.847222		2	.930555
	3	.6857		3	.770833		3	.854166		3	.9375
	4	.694444		4	.777777		4	.861111		4	.944444
	5	.701388		5	.784722		5	.868055		5	.951388
	6	.708333		6	.791666		6	.874999		6	.958333
	7	.715277		7	.798611		7	.881944		7	.895277
	8	.722222		8	.805555		8	.888888		8	.972222
	9	.729166		9	.8125		9	.895833		9	.979166
	10	.736111		10	.819444		10	.902777		10	.986111
	11	.743055		11	.826388		11	.909722		11	.993055
9	0	.75	10	0	.833333	11	0	.916666	12	0	1.

The Construction of the foregoing TABLE.

Let it be required to find what part of a foot one second is in Decimals.

1. One foot reduced into seconds, makes 144 seconds.
2. The vulgar fraction will then be $\frac{1}{144}$ of a foot.
3. Divide the upper term by the lower, and the quotient thence arising will be the answer.

```
144)1.000000(.006944+
       864
       ----
       1360
       1296
       -----
         640
         576
         ----
          640
          576
          ----
           64
           ==
```

After the same manner the whole table is made except in the case of inches only; as in the case of one inch, where the vulgar fraction will be $\frac{1}{12}$ of a foot. Divide the upper term by the lower, as before, and you have the quotient for the answer.

```
12)1.000000(.083333+
         4
```

Note 1. If the given part of a foot consists only of inches, the divisor need be no more than 12, because 12 inches make 1 foot.

2. If the given part of a foot consists of seconds only, or inches and seconds together, then 144 must be the divisor, because 144 seconds make 1 foot.

The Use of the foregoing TABLE.

Let the first example in multiplication be given, *viz.*

	F.	I.
Multiply	7	3
By	4	7

Look in the table for 3 inches, against which stands .25.——Again, look for 7 inches, against which stands .583333.——Hence it follows, that 7 f. 3 in. = 7.25 f. and 4 f. 7. in. = 4.583333 f.

Note. It is common in any large number of decimals, to save trouble in the operation, by making one of them one part larger, which cuts off all the following figures; thus, 4.58333 f. may be made 4.584 f.

```
            F.
Multiply  7.25
      By  4.584
         ------
           2900
          5800
         3625
        2900
        -------
        33.23400
              12
        --------
         2.808
            12
        --------
         9.696
        ========
```

	F.	I.	''
Ans.	33	2	9

Again; Let the first example in feet, inches, and seconds be given, viz.

	F.	I.	''
Multiply	7	3	2
By	1	7	3

Look in the table for 3 in. 2 sec. and against them you will find .263888; also look in the same table for 7 in. 3 sec. and against them you will find .604166; then by shortening the decimals.

Multiply	7.264
By	1.6041
	7264
	29056
	43584
	7264
	11.6521824
	12
	7.82616
	12
	9.91392
	12
	10.96704
	12
	11.60448

	F.	I.	"	'''	''''	
Anſ.	11	7	9	10	11	*the difference being inconſiderable.*

Diviſion of Duodecimals.

F.	I.	"	F.	F.	I.	"
2)146	7	10(	73	3	11	
3)761	4	11(				
4)963	2	10(				
5)186	1	10(				
6) 76	3	11(				
7)186	1	10(				
8)712	8	4(				
9)812	3	5(				
10)861	11	10(				

F.	I.	"	'''	''''
11)123	4	5(		
12) 76	8	7(		
7) 86	3	7	4	8(
8) 98	4	6	9	1(
9) 86	2	1	1	7(
10) 47	3	4	6	1(
11) 96	2	7	11	4(
12) 83	1	6	9	10(
12) 78	10	11	10	9(

Note 1. It very ſeldom happens that the diviſor conſiſts of more than one denomination; yet becauſe ſuch diviſors may ſometimes offer themſelves, I will give a few for the reader's ſatisfaction, which muſt be wrought after the manner of Long Diviſion, and may ſerve alſo as proofs to ſome of the foregoing examples in Multiplication.

2. This ſort of diviſion often admits of two figures at once in the quotient.

Examples.

```
                F.   I.  F.    I.  ″ F.  I.
F.   I.    4    5)33     1     6(7    6
4    5 × 7=     30   11
               ----------------
                 2    2    6
4    5 × 6=      2    2    6
               ----------------
                           0
                          ===
```

Note, If the feet in the quotient conſiſt of more than one figure, you muſt conſider,

1. How many figures are required in the feet by common diviſion.
2. If the feet required conſiſt only of two figures, you muſt multiply the diviſor by the firſt figure (which ſtands in tens place) with a cypher annexed. But,
3. If the feet required conſiſt of three figures, you muſt multiply the diviſor by the firſt figure (which ſtands in hundreds place) with two cyphers annexed; and the next figure in the quotient (which ſtands in tens place) with one cypher annexed.
4. Whatever the product is in feet and inches let it be placed under the dividend, in ſuch manner, that feet and inches may ſtand under feet and inches and units under units.
5. With regard to the number of feet in the dividend, you muſt proceed according to the common method of long diviſion, till you have obtained the number of feet required in the quotient.

```
                     F.   I.  F.        I.  ″ F.   I.
F.     I.    184     8)235.45     0     0(127    6
184    8 × 100 =       184.66     8
                     ----------------
                       507.8      4
184    8 ×  20 =       369.3      4
                     ----------------
                       1385       0
184    8 × 7   =       1292       8
                     ----------------
                         92       4     0
184    8 × 6 in. =       92       4     0
                     ----------------
                                        0
                                      =====
```

```
                    F.   I.   F.     I.  ″    F.   I.
F.     I.     48    9)3733    5      3   (76   7
48     9 × 70 =       3412    6
                    -------------
                       370   11
48     9 × 6  =        292    6
                    -------------
                        28    5      3
48     9 × 7 in. =      28    5      3
                    -------------
                                     0
                                   =====
```

			F.	I.	F.	I.	"	F.	I.
F.	I.		79	8)	3100	4	4(	38	11
79	8	×	30	=	2390				
					7104				
79	8	×	8	=	6374				
					73	0	4		
79	8	×	11	=	73	0	4		
						0			

F.	I.	F.	I.	"
6	7)	31	3	3(
8	10)	87	7	2(
8	9)	83	10	3(
12	9)	130	8	3(
11	5)	140	9	8(
9	3)	116	4	9(

F.	I.	F.	I.	"
39	8)	1847	9	8(
84	6)	6048	9	6(
19	10)	1518	10	10(
95	2)	8017	9	6(
26	8)	1895	6	8(
18	8)	673	6	8(

F.	I.	"	F.	I.	"	'''	''''	F.	I.	"
1	7	3)	11	7	9	11	6(	7	3	2
			11	2	9					
			5	0	11					
			4	9	9					
				3	2	6				
				3	2	6				
						0				

F.	I.	"	F.	I.	"	'''	''''
7	3	8)	62	6	7	9(	
3	10	6)	28	7	7	0(	
7	1	9)	55	2	9	3	9(
3	9	2)	13	10	10	4	8(

F.	I.	"	F.	I.	"	'''	''''
12	3	10)	119	8	2	10	10(
9	8	7)	62	7	3	9	4(
3	2	1)	7	2	8	11	4(
8	9	10)	48	11	2	8	10(

FINIS.